THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXVIII. No 20. Whole No. 1,458. | NEW YORK, MONDAY, MAY 18, 1903. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—

Twenty-sixth Annual Meeting, Western Gas Association..... 761

EDITORIALS—

Briefly Told..... 762

The Twenty-Sixth Annual Meeting, Western Gas Association—Death of Mr. Jno. D. Higgins—Notes.

Calorimetry, by Mr. E. Fearon..... 762

Selenium in Coke..... 763

Activity in Coal and Coke Development, by Mr. F. E. Saward..... 764

*Chimneys for Gas Stoves, by Mr. C. F. Hauss..... 765

*Is the Zigzag Flue Necessary for Heating Secondary Air? by Mr. Jas. Whyte..... 766

Economical and Safe Limits in the Size of Central Stations..... 768

The Determination of Benzene in Illuminating Gas, by Messrs. L. M. Dennis and J. G. O'Neill..... 770

Points in the Design of a Power Plant, by Mr. W. H. Booth..... 772

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 773

Annual Meeting, Detroit, Mich.—Doings of the Philadelphia Company—Proposed Company for Newport, Tenn.—Further, in the Atlantic City (N. J.) Case—An Original "Kick"—Something from Lansing, Mich.—The Calumet (Mich.) Light, Heat and Power Company—An Effective "Ad."—No Receiver for the Monroe County (Pa.) Company—How They do Things at Champaign, Ills.—Sale of the Rome (Ga.) Works—Annual Meeting, Cincinnati Company—Personal—And Other Items.

The Market for Gas Securities..... 775

[OFFICIAL NOTICE.]

Twenty-sixth Annual Meeting, Western Gas Association.

OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 27th, 1903.

The Twenty-sixth annual meeting of the Western Gas Association will be held at the Claypool Hotel, Indianapolis, Ind., May 20, 21, 22, 1903, and will be called to order by its President, Mr. A. H. Barret, of Louisville, Ky., at 10 A.M., Wednesday, May 20.

The managers of the Claypool Hotel announce a rate, on the American plan, of $3 per day and up; on the European plan, a rate of $1.50 and up.

The English Hotel, located about one block away, and which is under the same management, offers rates on the American plan of $2.50 per day and up; on the European plan, $1 per day and up.

The Claypool is new and modern, with ample accommodations for all.

The sessions of the Association will be held in a room provided by the Claypool Hotel.

The Executive Committee has arranged for the following papers:

Naphthaline, by Dr. W. H. Birchmore, New York city.

Gas and Meters, by Mr. John McIlhenny, Philadelphia, Pa.

The Most Economical Yield per Pound of Coal, by Mr. James Somerville, Indianapolis, Ind.

Increasing the Sale of Gas to Existing Customers, by Mr. B. W. Perkins, South Bend, Ind.

Municipal Ownership, by Mr. A. E. Boardman, New York City.

Heat Conductivity of the Different Clays, by Mr. H. A. Wheeler, St. Louis, Mo.

The High Pressure Gas Main under the Mississippi River at New Orleans, by Mr. Thos. D. Miller, New Orleans, La.

Low Candle Power, by Capt. W. H. White, New York City.

Wrinkle Department, Edited by Mr. W. E. Steinwedell, Cleveland, O.

Reports will be made by the following committees: On Specifications for Gasholders; World's Fair Committee.

The Western Passenger Association, from all points in Eastern and trans-Missouri territories, Central Passenger Association, Trunk Line Association and the Southeastern Passenger Association have granted rates of one and one-third fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Association includes all State divisions east of the Mississippi river except New England. The following States and territories west of the Mississippi river are in the territory covered by the Railway Associations granting reductions: North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first-class ticket at starting point, paying full fare for same, obtaining from the agent a certificate, stating that the person whose signature appears on same has purchased, at full tariff fare, one first-class ticket to Indianapolis, which certificate, after it has been signed by the Secretary of the Association and a representative of the Passenger Association, will entitle the purchaser to a one-third rate returning home.

Apply to the ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by the Passenger Associations mentioned above should purchase a ticket to the nearest point within one of said Associations, and from there purchase a ticket to Indianapolis, obtaining a certificate which will, if properly indorsed in Indianapolis, entitle them to a one-third fare returning to the place from which certificate was obtained, provided it is indorsed by a representative of the Passenger Association, who will be present at the meeting, and the undersigned.

Those who live in Western Passenger Association territory should consult the local agent several days in advance of purchasing ticket to Indianapolis, in order to reach an understanding with the different roads as to junction point, via which they will make rates applicable.

LIBRARY OF CONGRESS. MAY 18 1903 SMITHSONIAN DEPOSIT.

Some local agents sell to junction points, where delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

All queries sent to the Secretary for the Question Box will be assigned, in advance of the meeting, to members for answer.

The Secretary will be pleased to answer any question relating to the meeting, and will mail application blanks for membership to applicants. The membership fee is $10, which includes the first year's dues; annual dues $5 thereafter. The Association publishes and distributes, free of charge, to its members the Proceedings of the Association, which alone is worth more than the annual dues.

Yours truly,
JAS. W. DUNBAR, Sec'y.

BRIEFLY TOLD.

THE TWENTY-SIXTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.—The Western Gas Association will this week hold its twenty-sixth annual meeting in Indianapolis, Ind., under circumstances that are certain to cause the assemblage to figure as a noteworthy one in its history. Its President, Mr. A. H. Barret, Engineer of the Louisville Gas Company, although not yet in his half-century of age, can point to an active record in connection with the engineering department of his Company that covers well over 25 years, and with the knowledge that should be of such experience, he has, with the able assistance of Secretary Dunbar, arranged for a paper list that puts doubt respecting the value of the technical side of the meeting out of court. His address, of course, together with the special reports to be presented, and remembering Editor Steinwedell's collection of "Wrinkles," would seem to foreshadow a lengthy set of technical sittings. It is worthy of note that out of the eight papers to be read no less than four are to be handed in by men who have in their time and day occupied the chairs of the Western or American Associations. And another number is to come from the thought and pen of a man who is respected for his good work and loved for his personality by every man in the profession—Mr. John McIlhenny. The entertainment schedule is of an entirely novel order, and the "sterner kind" of the delegates will have ample reason to say when the "services" are over, that they enjoyed them—the Committee of Arrangements comprises Messrs. James Somerville, John R. Pearson and C. M. Keller. There need be no fear that the Claypool will not be in good working order, and the arrangements made for the comfort of those who will attend the meeting could not be excelled; for we suppose that intending attendants have already made their applications for housiug and the like. The gentler sex are to be taken care of by a committee comprising Mistresses James and Jno. Somerville, Durbin, Fairbanks, Bookwalter, Williams, Morse, Pray, Coleman, McGowan, Pearson and Smith. The programme outlined under the direction of the named fair ones includes drives and trolley rides, *ad. lib.*, a supper at the Country Club, a dinner at Broad Ripple and a formal reception at the Claypool Hotel. Judging from the indications respecting the attendance, we may only say that the East will be responsible for the presence of at least two score. In fact everything points to a good meeting, no matter from what position the prophet would take. Study the official notice closely so that no undue or unnecessary expense may be incurred in going to or coming from the meeting place. The following lines from a letter just to hand from Mr. James Somerville, Chairman of the Entertainment Committee, we will hazard the reprinting: "We hope every husband who intends coming to Indianapolis will bring his wife with him, and that the other fellows will bring their sisters and their sisters' friends, who will all secure a hearty welcome."

DEATH OF MR. JOHN D. HIGGINS.—We regret to have to chronicle the death of Mr. John D. Higgins, whose decease occurred the afternoon of the 4th inst., at his home, 104 East Liberty street, Rome, N. Y. Deceased, who was born in Perry, N. Y., April 15, 1824, became a resident of Rome in 1867, where he entered the service of the Rome Gas Light Company, and became its Superintendent in 1869, resigning the post in 1896, because of physical infirmity attendant on his advancing years. He was prominent in the religious, commercial and social life of Rome. He is survived by his wife.

NOTES.——

THERE seems to be quite a scramble or contest among certain politicians of Massachusetts to serve as the successor to Mr. Charles H. Gifford, on the Board of Gas and Electric Light Commissioners, whose term of office expires this month. Meanwhile it is not certain that Governor Bates has determined not to reappoint Mr. Gifford, whose services have been freely rendered, even if some of his opinions were displeasing to the Lawson-Whitney coterie.

THE Legislature of Connecticut has rejected the resolution to fix the maximum selling rate for gas in Norwalk at $1.25 per 1,000.

THE officers named to manage the affairs of the Chelsea (Mass.) Gas Light Company for the ensuing year are: Directors, J. L. Richards, R. J. Richardson, H. S. MacPherson and George W. Moses; President, Jas. L. Richards.

Calorimetry.

[A paper read by MR. E. FEARON, of Salford, at the last meeting of the Manchester and District Junior Gas Association, England.]

To anyone who is of an observant turn of mind, it must be evident that the usual methods of gas supply in vogue up to the present time will undoubtedly undergo a radical change in the near future. Ever since gas was first introduced into our streets and houses, the question of its illuminating power has been paramount; and rightly so, under the old conditions, as there must always be some standard or other to which buyer and seller can refer when the quality of the material sold is to be determined. But the conditions have changed very greatly in the last 10 years or so, due to the use of gas as a heating and motive power, and to the introduction of incandescent lighting; and there is now no necessity for supplying gas of 18 to 20-candle power, and over, as is done in the north of England and in Scotland. That this is being recognized, is shown by the passing of the South Metropolitan bill, which granted the Company permission to supply gas of 14 candles; and all over the country the tendency is to reduce the illuminating power of the gas supplied. On the Continent, gas of much lower quality is sent out; 10 or 11-candle power being quite common in some of the large towns in Germany—*e. g.*, Magdeburg, Dessau, Bremen, etc.

If, however, the old standard is to be discarded, we must substitute another; and there can be little doubt that the new standard will be the calorimeter, as the heating power of the gas will then be the all important factor. That being so, it is necessary that everyone connected with the manufacture of gas should be familiar with the methods of determining its calorific value. One way of doing so is by calculation, from an analysis of the gas. The following table gives the calorific value ascribed to the various heat giving constituents of coal gas:

	1 Cubic Foot of Gas at 60° F. 30 In. Bar.
Hydrogen	325.0 B.T.U.
Marsh gas	1,024.0 "
Carbon monoxide	323.5 "
Heavy hydrocarbons	2,484.0 "

From these all the heating power is derived; and having obtained an analysis of the gas in question, it is a simple matter to calculate its calorific power.

An analysis of high grade gas, such as is supplied in Manchester, would give about the following percentages: Hydrogen, 46; marsh gas, 35; heavy hydrocarbons, 6.5; carbon monoxide, 6; carbon dioxide, 2; oxygen, 0.5; and nitrogen, 4. Taking the values and multiplying, we get—

$$\begin{aligned} 46.0 \times 325 &= 14{,}950 \\ 35.0 \times 1{,}024 &= 35{,}840 \\ 6.5 \times 2{,}484 &= 16{,}146 \\ 6.0 \times 3{,}235 &= 1{,}941 \\ \hline & 68{,}877 \end{aligned}$$

Or 688.77 B.T.U. per cubic foot of gas.

As, however, an accurate analysis of a gas is a rather lengthy proceeding, requiring considerable technical skill on the part of the operator, such a method of obtaining the calorific power is seldom employed.

The alternative method of determining it is by means of a calorimeter, in which a known volume of water is heated by a known volume of gas. Until fairly recently, very few gas works possessed such an instrument; as, before the late Mr. Hartley produced his calorimeter in 1884, the only ones in use were cumbersome and not easy to manipulate. At the present time, there are several on the market, mostly based on the Hartley pattern, of which probably the best known is the Junkers. I have brought one with me for your inspection; and, as you will see, it consists of a metal combustion chamber, surrounded by a water jacket, through which passes a double row of vertical tubes, open at both ends. The products of combustion pass through these tubes in a downward direction, while the water flows outside them in an opposite direction—thus cooling the products to the temperature of the water. The water is led to a regulating funnel, designed to keep a constant head; and from there it passes through a quadrant cock, and over the bulb of the inlet thermometer into the body of the instrument. Here it becomes heated, and rises to the top, past a series of baffle plates, to the outlet funnel, encountering on its way the bulb of the outlet thermometer. From the outlet funnel, the water either runs to waste or is led into a measuring vessel. The gas to be tested passes first through an accurate experimental wet meter,

and then through a delicate bell governor, in order to insure an unvarying pressure.

In order to make a test, the water is turned on; and when running from both overflows, the gas is lighted in the bunsen burner, and consumed at the rate of about 6 cubic feet per hour—the speed of the water being regulated till there is a difference of some 10° C. between the inlet and outlet thermometers. After a few minutes have elapsed, and the difference between the inlet and outlet is constant, and the condensed water is dripping from the small pipe at the bottom, the test may be commenced. The air inlet of the burner must be regulated till the right quantity is being admitted, which can be seen by observing the flame by means of a small mirror. Wait till the pointer of the meter reaches the zero mark, then quickly switch the outlet water tube from waste to the measuring vessel, and when the pointer again reaches zero reverse the operation; in the meantime having carefully noted the readings of the two thermometers. From the data so obtained, it is a simple proceeding to determine the calorific value. For instance, supposing that $\frac{1}{12}$ cubic foot of gas has been consumed, and that 1,400 cubic centimeters of water have been raised from (say) 16° C. at the inlet to 25° C. at the outlet. Then—

If $\frac{1}{12}$	cubic foot has raised	1,400	c.c.	through	9° C.
1	" would raise	16,800	"	"	9° C. and
1	" " "	151,200	"	"	9° C.

The unit taken is the calorie, which is the amount of heat required to raise 1 kilogramme (1,000 c.c.) of water 1° C.; so that, dividing by 1,000, we get 151.2 calories as the heating value of our sample of gas. The quantity of gas consumed must be reduced to standard conditions—*i. e.*, 60° F., and 30 inches pressure. Suppose the temperature of the gas in the meter to be 62° F., and the barometer to be at 29.9 inches, the tabular number is 0.991, and 151.2 ÷ 0.991 = 152.5 calories.

This is the gross calorific value; and in order to obtain the efficient heating value, it is necessary to deduct the amount rendered latent. This is done by collecting the condensed water resulting from the combustion of 1 cubic foot of the gas. A small measuring glass is placed beneath the tube at the base of the calorimeter, and the condensed water collected therein; then each c. c. so collected corresponds to 0.6 calorie. Assuming that 22 c. c. are collected, that gives us 13.2 calories which must be deducted to obtain the net value: 152.5−13.2=139.3 calories.

The foregoing may be stated simply thus:

$$\frac{\text{Volume of water in liters} \times \text{difference in temperature}}{\text{gas consumed.}}$$

= calorific power of 1 cubic foot of gas (gross).

In England, the British thermal unit is the standard; and this is the amount of heat required to raise 1 pound of water through 1° F. To express calories in B.T.U., it is necessary to multiply by 3.97, so that 139.3 × 3.97 = 553.02 B.T.U.

If reliable tests are to be made, absolutely similar conditions must prevail; and to insure this, several precautions must be taken, of which the principal are: (1) A constant head of water. (2) Exclusion of all draughts. (3.) An automatic switch to allow the water to flow from waste to the measuring vessel, and *vice versa*.

The first can be met by having an overhead tank, fed by a ball cock, whence the water is led to the inlet of the calorimeter. The second is not so easily dealt with, and will require a special room with double doors, etc., and provided with proper inlets and outlets for the air, so arranged that the volume of air can be frequently changed without causing draught. It also entails great care on the part of the operator to avoid movement as much as possible during the time a test is in progress; and this brings us to the third requirement—an automatic switch. It should not be a difficult matter to arrange one, after the fashion of the automatic cut-off in the Referees' sulphur test, actuated by the meter itself; thus reducing the chance of error to the reading of the thermometers. Another requisite in the ideal calorimeter is that the two thermometers should be side by side, the outlet slightly lower than the inlet, so that the tops of the two columns of mercury would be almost on a level during a test, and the reading of them thereby simplified, thus further reducing the chance of error.

The Simmance and Abady calorimeter is one of the most recent to be placed on the market, and possesses several improvements. In order to ascertain whether the flow of water is constant, a gauge glass is fitted on the inlet, the least variation in water pressure being at once apparent; and if it occurs while a test is in progress, such test can be discarded. Another improvement consists in having a swinging bucket-shaped funnel fixed on the outlet pipe and weighted so that normally the water is directed into another funnel and runs to waste. When it is desired to make a test, the measuring jar is placed in position: and as the meter point passes zero, the bucket is swung over in a fraction of a second, without causing any alteration in the flow of water, as was the case with the rubber tube used in the older forms. The thermometers, too, are large open scale ones, and placed side by side, thus facilitating the reading of them. The patentees recommend the use of very small quantities of gas—say, $\frac{1}{10}$ cubic foot—as the possibility of error while making a short test is less than in the case of a long test, in which as much as 1 cubic foot of gas is used.

An important consideration, if the calorimeter is to supersede the photometer, or be used in conjunction with it, is the standardization of the instrument, which will probably be carried out by the Standards Department of the Board of Trade. A pure gas of known calorific value, such as hydrogen, would appear to be the most suitable for this purpose, although pentane air gas, as used in the Harcourt lamp, has also been proposed; and all instruments would be stamped, and sent out with a certificate stating either that they were correct, or (if not) giving a constant by which to correct the readings.

It is well known that the calorific value of a gas is not lowered proportionately as the illuminating power is lowered; and some tests which have been made on various qualities of gas show this very markedly, also the wastefulness of supplying rich, high priced gas to be consumed in incandescent burners, gas engines, cookers, etc., when a cheap gas of a little less heating power could be supplied to the great advantage of everyone concerned.

TABLE I.

Gas Made From—	Illum. Power at 5 Cubic Feet per Hour. Candles.	Calorific Value B.T.U. Gross.	B.T.U. per Candle.
Cannel	24.70	694.83	28.13
Mixed coal and cannel	20.13	624.42	31.02
Coal only	16.00	564.42	35.28
"	13.23	556.79	42.08
"	10.09	514.27	50.96
10-candle gas enriched with benzol	24.70	620.60	25 12

That the efficiency of incandescent burners is not impaired by consuming low grade gas in them, is proved by the following comparative results which I have obtained.

TABLE II.

Burned Used.	Consumption of Gas per Hour. Cubic Feet.	Illuminating Power. Candles.
Standard Argand	5.0	18.85
Welsbach "C"	3.5	54.25
Standard Argand	5.0	15.09
Welsbach "C"	3.5	55.00
Standard Argand	5.0	19.07
Welsbach "C"	3.5	58.32
Standard Argand	5.0	9.13
Welsbach "C"	3.5	54.50
Standard Argand	5.0	6.55
Welsbach "C"	3.5	47.08

It may be as well to remark here that some difficulty arises in assigning the true illuminating power to a low grade gas, as so much depends upon the rate at which it is consumed in the burner; and no doubt some of the conflicting results that are published from time to time are due to this. The gas in Table I., having an illuminating power of 10.09 candles, was tested with the flame filling the chimney, and burning at the rate of about 6.25 cubic feet per hour. The same gas, consumed at the rate of about 5.25 cubic feet per hour, gave only 4.86 candles; the values in both cases, of course, being reduced to the standard rate of 5 cubic feet.

Selenium in Coke.

The *Journal of the Society of Chemical Industry* (England) reprints the following paper, by Mr. J. F. Smith, chemist of the Halifax Gas Works, which paper was read at the last meeting of the Yorkshire Section of the Society:

Some time ago, while examining samples of coke for arsenic by means of the sulphide method, it was noticed that some of the samples gave a sulphide of a lemon-yellow color, while on passing more hydrogen sulphide, a portion of it changed, and some red particles separated; on allowing the liquid and precipitate to stand in a warm place for about 18 hours, the color of the precipitate was found to have changed to a dark brown. Larger quantities of the precipitate were prepared and analyzed qualitatively, the results of which showed that it consisted only of selenium and sulphur. Deposits obtained in a Marsh's appara-

tus were oxidized, sublimed, and examined under the microscope, and were found to consist entirely of a fernlike structure.

As some of the samples contained traces of arsenic as well as selenium, it was decided to try the method and apparatus devised by L. v. Babo and Fresenius, for the purpose of separation. It will be remembered that this method is based on the fact that a mixture of 3 parts of sodium carbonate and 1 part of potassium cyanide will retain any substance other than arsenic, when heated in a slow current of carbonic acid. It was thought that by taking advantage of this, the arsenic could be obtained from the precipitate in the form of a mirror, so that it could be estimated by comparison with standard mirrors prepared in the same way, and then obtain the selenium from the residue left in the boat, in which it would probably be in the form of selenocyanide of potassium, which is soluble in water, and from which solution the selenium could be precipitated, by means of hydrochloric acid, as a red flocculent precipitate, which could be washed, dried, and weighed. After several trials it was found that it would be necessary to reduce the first precipitate obtained from the residue a second time, and also that it would be necessary to purify the red precipitate obtained after this second reduction by dissolving it in a saturated solution of potassium cyanide, and reprecipitate by means of hydrochloric acid.

The following was the method of proceeding finally adopted: From 100 to 200 grammes of the finely ground coke or fuel were weighed and placed in a large porcelain basin, mixed with sufficient distilled water to form a paste, to which was added from 100 to 200 c.c. of pure hydrochloric acid. The dish and its contents were then heated on a water bath, and about 0.5 gramme of pure chlorate of potassium was added every 5 or 10 minutes for about an hour, after which the liquid was poured through a filter, and the residue again heated with pure hydrochloric acid and chlorate of potassium until nothing more could be extracted that was precipitated with sulphuretted hydrogen. The contents of the basin were then transferred to the filter and well washed with hot distilled water. The combined filtrates and washings were then heated on a water bath until the smell of chlorine had disappeared. The solution was then reduced with a slight excess of pure sulphurous acid, and again heated until the excess of sulphur dioxide was expelled. The solution was then allowed to cool to 70° C., and a current of pure sulphuretted hydrogen, prepared by the method given by Divers and Shimidzu, in the Chemical Society's Transactions for 1884, page 699, was passed through it until saturated. The solution, etc., were then allowed to stand in a warm place during the night, after which the precipitate was collected and washed in the usual manner, the filtrate and washing being again treated with sulphuretted hydrogen to make sure that everything had been precipitated. The precipitate was then repeatedly digested with a little ammonium sulphide for some time on a water bath, after which the solution was filtered from any suspended matter, which was well washed, and the washings added to the filtrate. The sulphides were then reprecipitated from the solution by means of pure hydrochloric acid, and the precipitate was collected on a small filter, washed and dried at a temperature a little below 100° C. The filtrate and washings were then concentrated, and if anything separated it was added to the main precipitate.

When the precipitate was dry it was mixed with dried pure potassium cyanide and carbonate of soda; the mixture was then placed in a porcelain boat. The boat and its contents were then placed in the reduction tube of a Babo and Fresenius apparatus and reduced in a slow current of dry carbonic acid according to their instructions, and any mirror formed was compared with standard mirrors for the estimation of the arsenic. After the apparatus had cooled the boat was withdrawn and the residue dissolved in hot distilled water; the solution so obtained was now saturated with pure hydrochloric acid and boiled for some time; the precipitate was filtered off, washed, dried, and again reduced with a fresh portion of the cyanide and carbonate of soda mixture. Any arsenic deposited in the reduction was estimated and added to the amount found by the first mirror. The residue in the boat was again dissolved in water, and the solution saturated with hydrochloric acid and boiled; the red precipitate was collected on a small filter, washed, and dissolved in a hot saturated solution of potassium cyanide; the solution was then filtered, if necessary, and the solution saturated with pure hydrochloric acid, and boiled for about 15 minutes, after which it was allowed to stand for some hours. The red precipitate of selenium was collected on a tarred filter, washed, and dried at a temperature slightly below 100° C., and finally over concentrated sulphuric acid until the weight was constant, the increased weight of the filter giving the amount of selenium present in the amount of coke taken.

The amount of selenium found in coke from several parts of Yorkshire by the above method varied from a very slight trace to 0.015 per cent. Though all the reagents used for the above had been specially purified, it was preferred to make blank tests, using the same quantities of the regent, etc., as in the actual tests, in order to avoid any chance of contamination from the vessels, etc., used.

Activity in Coal and Coke Development.

By Mr. Frederick E. Saward, in *Iron Age*.

Work continues along the line of development in our coal and coke industries. With the opening of good weather there come to hand many reports of this activity, and it does not appear to be confined to any portion of the country. Wherever the coal is found near to a market it is to be worked.

Even in Pennsylvania there is no letting up to the building of coke ovens, and activity continues in the Pittsburg district and among independent manufacturers at an increasing rate. Among the contracts for the extension of coke plants and for the building of new ones which have been awarded during the past week are those of the Victoria Coal Company for 50 new ovens at Perryopolis, Pa.; the Connellsville Coke Company for new ovens in Fayette county; the Oak Ridge Coal & Coke Company for 50 new ovens at Hastings, Pa., and a number of smaller plants along the Monongahela river. The Gilmore Coal & Coke Company have also increased their coking coal lands, and the O'Connor Coke Company have secured extensive new lands for coking purposes in Washington county.

The Nittany and Bellefonte furnaces of Bellefonte, Pa., are another interest which will soon have an independent supply of coke, manufactured expressly for their own use by a company composed of members of both firms. These gentlemen have purchased 1,100 acres of coal lands in the southwestern corner of Jefferson county, Pa., situated between the Bell's Gap Railroad and the B. R. & P. Railroad, and intend to begin the erection of 200 coke ovens, all of which will be finished next fall.

Henry W. Oliver has bought 1,000 acres of land containing the gas coal seam near Finleyville, Pa. It adjoins a tract of 4,000 acres owned by Mr. Oliver. The sale was for cash and the price is said to have been about $200 per acre. The price is about the highest yet paid for Pittsburg vein coal in that neighborhood, but the figures quoted were paid on account of the quality of high rate gas coal. The lines of value are being more and more strongly drawn between ordinary steam or domestic coal and the gas coal. It is the opinion of many coal men that there will in the future be as marked and as great a relative difference in value per acre between gas coal and steam coal as has existed for a long time between Connellsville coking coal and gas coal.

In line with other large independent concerns of the country the Wheeling Steel & Iron Company have secured their own coke supply by the purchase of property on the Monongahela river, investing no less than $500,000. Application has been made for a charter for the Wheeling Coke Company, with a capitalization of $50,000. The Wheeling Coke Company recently purchased 1,000 acres of coal land in Luzerne township along the Monongahela river from J. V. Thompson and others for $500,000. Their holdings are close to those of the La Belle Coke Company and adjoin those of the Crucible Steel Company. The Wheeling Company will build 100 ovens at once. The Company are controlled by the Wheeling Iron & Steel Company interests and the stockholders are all stockholders in that firm.

At West Superior there has been a coking coal plant for some years past, and now there is a small by-product plant in the same vicinity, for work has been commenced on the construction of the coke ovens in connection with the plant of the Zenith Furnace Company at West Duluth. The driving of the pilings on which the docks will rest has begun. On the docks the coke ovens will be constructed. The work will be rushed, as the contract with the city calls for the furnishing of gas by January 1. There are to be 20 coke ovens constructed on the latest plans at a cost of about $8,000 each, and the total cost of the additions which have been planned will be between $300,000 and $400,000. The Northwestern Fuel Company, of Superior, will soon start work on the 108 coke ovens to be built on the Lehigh dock besides the old ones now in use.

I learn that before long there is going to be a great development in Eastern Kentucky coal lands by the Chesapeake & Ohio, up the Big Sandy particularly. Railroads for the coal of the isolated mountains of Kentucky have long been named among the certainties of the future. At least it seems as if these commercial necessities may be counted on within a definite and reasonable time. The Southern Railroad is now credited

with a scheme to build an extension from Middlesboro to Harlan Court House, following the lines of least resistance along the Cumberland river and opening the way for the great coal seams of Little and Big Black Mountains and the thinner beds of that rich region. Until recently this railroad extension has only been on the public mind. Railroads have a way of figuring things for themselves and doing them in their own good time. It seems likely now that the Southern has given this project careful consideration and has adopted a plan of action. Its men in charge of the field work have been called to several conferences with officers at headquarters within the last month or two, and persons interested in coal in the several counties through which the new railroad must pass are looking confidently for the beginning of work on the railroad within a year and for the completion of a line within the next two years.

The furnace now in course of construction ot Battelle, between Birmingham and Chattanooga, on the line of the Alabama Great Southern Railroad, is rapidly nearing completion and much of the machinery is on the ground. J. G. Battelle, of Columbus, O., in whose honor the new little furnace town is named, is President; Erskine Ramsey, of Birmingham, is Vice-President; J. F. Steins is Secretary and Treasurer; C. E. Bowron is Superintendent, and J. H. Dowling, of Chattanooga, is blast furnace superintendent. The furnace will have 4 William Tod blowing engines and a capacity of 250 tons, while the battery of coke ovens will run to the 300 mark. Three hundred houses, averaging 4 rooms each, will be rapidly erected and the little town of Battelle will soon assume importance in the industrial world.

Within the past month there has been quite a deal of activity about the mines of the Alabama Consolidated Coal and Iron Company, located at Lewisburg, Ala. A lot of construction work is being done, a coal washer being in course of erection, while 25 houses for miners' residences will soon be built near No. 2. This mine is expected to be in full operation soon. The coke ovens being constructed by the Miner Construction Company will soon be ready for the torch.

There has been a very great deal of discussion as to the advisability of combining several of the smaller operating concerns in Alabama; this is a most desirable feature when one considers the number of firms in that State, and the overwhelming preponderance of a few; there are the Tennessee Company with 3,200,000 tons, the Sloss-Sheffield with 1,300,000 tons, the Bessemer Company with 610,000 tons, and this leaves 32 concerns for the remainder of the large output of 10,000,000 tons for that State. R. C. Middletown has the matter in charge, and the latest advices are that he is meeting with a large degree of success.

Representatives of the coal companies who have been approached by Mr. Middletown do not deny that such a movement is on foot, but they are very reticent as to what point the negotiations have reached. Some of them go far enough to say that the consolidation of the companies, or at least the major part of them, would be advantageous to the commercial coal interests of the State.

There has been somewhat of an increase in the price of soft coal this year as against last. The price of soft coal to consumers during the coming year will be in the neighborhood of 75 cents per ton higher than the contract prices were in 1902. This is demonstrated by the fact that in 1902 the price f.o.b. at the mines in the Pocahontas, New River and Fairmount regions was $1.25 per ton, while the price this year will be $2 per ton. The price in the George's Creek region last year was $1.25 per ton, and this year it is $2.25 per ton, and the price of Pennsylvania coal in 1902, which was $1.25 per ton, will this year range between $1.75 and $2 per ton. Owing to an excess in output there are some reductions from these figures at present. The railroads advanced the freight rates on coal on April 1 10 to 15 cents per ton from the various regions shipping to tide, and this remains as a charge against the coal no matter what the tide or mine price is. It is believed that the trade will remain dull until the middle of July, but after that time the producers insist that there will be a state of activity during the balance of the year and that the railroads will not be able to carry enough coal to supply the demand.

There has also been an increased price had for coke, as compared with the contract prices ruling a year ago, so that one hears that furnace coke from the Connellsville and Lower Connellsville regions will be quoted at $4 a ton during the second half of the year, but this is doubtful, and there has been very little coke sold at $4 a ton this year, and none during the closing months of 1902. The operators, except those who were bound by contracts made during the first half of 1902, held off for the highest figure they could get. The quoted price of furnace coke at present is $4.25 per ton, and it will not be long until it can be bought at the ovens for a less figure. Operators who contracted for the summer output at that figure are considered well off, according to the present outlook. However, prices are yet some above this figure, and while there will be a settling down to normal conditions if the railroads are able to move production out of the region and furnish empty cars each day, still prices will remain at profitable figures.

Chimneys for Gas Stoves.[1]

By Mr. Charles F. Hauss.

The increasing use of gas stoves for cooking and heating purposes has not been taken into account by architects and builders as much as it should have been. Even though the same principles seem to be in use with gas stoves as are at hand in coal stoves, practice has shown that difficulties often arise after the gases of combustion reach the chimney. The fault lies principally in the chimney, which is usually built for a coal stove, and hence is larger than is necessary for a gas stove, as the latter does not deliver enough heated gas into the large chimney to properly fill and warm it so as to cause the necessary difference in density of air to create the draft. Naturally, much heat is lost to overcome this difficulty, which, with a properly proportioned chimney, would have been of service in heating the room.

It is often the case where several coal stoves or ranges are connected to one single flue, that, at times, one or more of the stoves are not under fire. But enough heat is always furnished to the flue to create a draft, and, incidentally, to overcome the cooling effects of the cold air entering the chimney from the stoves not in use.

Naturally, where there is economical use of the fuel, as is the case with steam or hot water heaters, where the gases of combustion reach the chimney at a comparatively low temperature, more than one connection to the chimney is not needed or permitted. This is especially the case with gas stoves in which the heat is nearly all used in the room for heating or cooking purposes, and where no draft is necessary to create combustion. Here the chimney is only necessary to carry off the noxious gases from the burning gas.

Even though theoretically this lower temperature in the chimney flue offers no objections, it is nevertheless a fact that, in practice, as soon as a well constructed gas stove is attached to a chimney to which no other stoves, especially coal stoves, are connected, it is found that the chimney is always wet, often to the extent of moistening the walls, or even to having the water run out of the bottom of the chimney; the products of combustion from a gas stove, like those from a coal fire, making large quantities of vapor which can only be carried out of the chimney if the gases are warm enough to absorb this moisture. When, however, a gas stove is connected to an ordinary large flue having other openings admitting cold air, this moisture or vapor is condensed and shows itself by wetting the walls, as mentioned above.

To avoid all this it will be necessary to have a separate small flue for each gas stove. In view of the fact that a very small amount of soot is deposited in a flue of this kind, it can be made without special care for ease of cleaning, and owing to the practical absence of heat, the walls can be thinner, so as to avoid the unsightly chimney breast in the room.

In Figs. 1, 2, 3 and 4 of the accompanying illustrations are shown

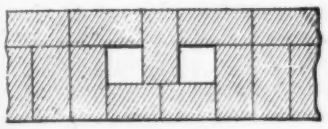


Fig. 1.—Flue 4 by 4 Inches.

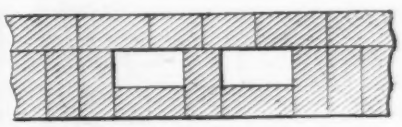


Fig. 2.—Flue 4 by 8 Inches.

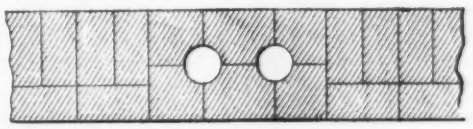


Fig. 3.—4-Inch Round Flue; Thin Wall.

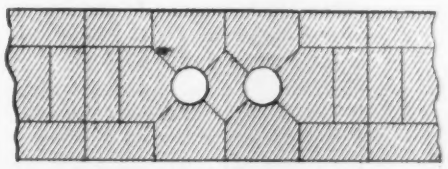


Fig. 4.—4-Inch Round Flue; Thick Wall.

1. *The Metal Worker.*

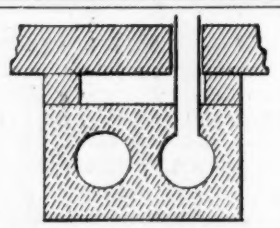


Fig. 5.—Flue Formed in Cement.

brick flues, square, rectangular and round. Fig. 5 shows round flues made of formed cement, a style which is especially adapted for wood buildings. These special bricks should not add to the cost of the building, inasmuch as the dimensions of the brickwork is considerably reduced.

Is the Zigzag Flue Necessary for Heating Secondary Air?[1]

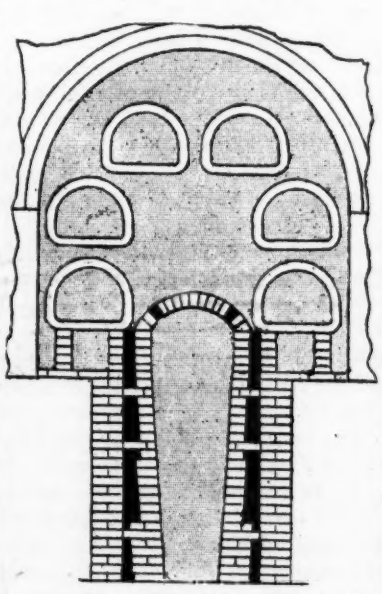
[A paper read by Mr. James Whyte, Seaham Harbor, at the last meeting of the North of England Gas Managers' Association.]

In bringing before you the following notes on secondary air heating, I know I am treading upon very delicate ground, as my experience does not confirm what, so far as I know, is the general method of heating secondary air for generator furnaces. I speak of these only, as I have had no experience whatever with regenerative furnaces. I know I am in good company with such men as Mr. Charles Carpenter and Mr. Valon in believing that air may have its temperature very materially increased although only a short time in contact with the hot brickwork. Some 17 years ago I employed a well-known firm to put in 3 beds of 6 retorts on the generative principle. Although assured that excellent results were obtained elsewhere from the same patent settings, I must say in our case the results were very disappointing. I do not lay the blame on the settings themselves, or their principle; the fault may have been ours. Be that as it may, the settings which were to do such good work and with trifling cost for repairs, etc., soon showed certain weak spots in their construction and working, as the whole of the brickwork in front of the furnaces was burnt away in 3 months and required renewal.

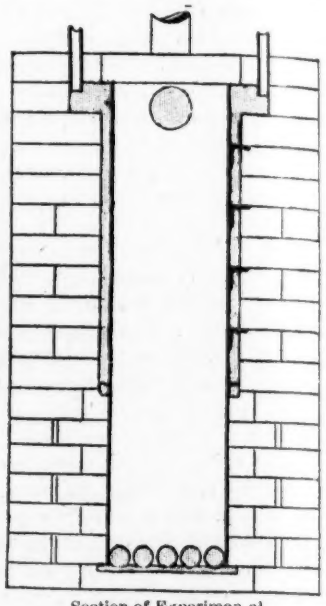
Flues Dispensed With.—When renewing the retorts afterwards, we made certain alterations, which considerably modified the wear and tear of the furnaces; but our make of gas was still very disappointing. I may explain that, as originally set, the secondary air had a zigzag flue, giving it, roughly speaking, some 20 feet of travel before entering the furnaces. After carefully considering the matter, I concluded that the idea of giving a long travel, so as to keep the air as long as possible in contact with the hot brickwork, was the correct one, but thought I could improve matters by leading the air flues round the back of the furnace with only a 4½-inch brick separating the two air courses—giving some 4 feet longer travel on each side. After a time we got up the requisite temperature, but with a greater consumption of coke. The conclusion I then arrived at was that the extra travel and sharp corners at the back of the furnaces meant extra pull of the chimney, which would tend to draw the heat too quickly from the retorts; hence the increased fuel. My next step in renewing these settings was a retrograde one. I not only cut off the flue at the back of the furnace, but also two of the side flues, which reduced the travel of the air to something like 15 feet. I found our heats as good, and the consumption of coke slightly less. I afterwards reduced the travel to about 9 feet, with just as good results. Since then, I have dispensed entirely with the flues—simply passing the air into a cavity behind the furnace casing and allowing it to travel slowly upwards in contact with the hot brickwork.

Wrong in Theory but Right in Practice.—My object in bringing this matter before you is to endeavor to get the benefit of the large and mature experience of some of our members, who have given so much time and consideration to the heating of secondary air. I know that, theoretically, I am wrong; but practically I think I am right in saying that I can get the air hotter by the latter method. I may say, further, that what strengthened my opinion and induced me to bring the subject before you now was the results of some experiments I made 3 years ago. These results astonished me, and even now I cannot account for them. I had a man setting some retorts for me with a very large experience in this class of work, having set thousands of them in all parts of the kingdom. While quite willing to set them to my idea, with the open space behind the sides of the furnace lining, yet he considered I was making a great mistake in so doing. His argument was that a long travel against the hot brickwork for the air was bound to give better results. He pleaded very hard to be allowed to put in one setting to his own idea.

Results of Tests.—We argued the matter time after time, but got no nearer a settlement until we agreed to build a small experimental furnace of sheet iron, the internal dimensions of which were 12 inches by



Section of Oven, Showing Producer and Air Flue.



Section of Experimental Producer.

12 inches and 4 feet high. On one side we left an open space, and on the other we riveted 4 pieces of 2-inch angle iron corresponding to the zigzag flues. He built the brickwork, and every care was taken that the thing should have a fair trial without prejudice either way. I had two pieces of ¾-inch wrought iron tube cut exactly the same length (10 inches), both fixed at the same level—viz., 30 inches from the top for inlets for air. The outlets were 1-inch pipes, both of the same length; and a Fahrenheit thermometer was hung in by means of a disk of rubber insertion with a hole in it, through which the thermometer stalk was passed. These disks rested upon the pipe ends, which were serrated to allow the heated air to escape. All being in order, a fire was lit; and the following results were indicated by the thermometer:

First test, with open cavity,	65°	with flues,	58°	difference,	7°
Second	"	"	167°	"	118°	"	49°
Third	"	"	220°	"	179°	"	41°
Fourth	"	"	290°	"	220°	"	70°
Fifth	"	"	300°	"	230°	"	70°
Sixth	"	"	290°	"	208°	"	82°
Seventh	"	"	245°	"	200°	"	45°
Eighth	"	"	220°	"	175°	"	45°
Ninth	"	"	245°	"	205°	"	40°

We watched carefully the result of each test, which, I may say, were of from 15 to 20 minutes' duration, made at three different times and on two separate days. The retort setter felt sure the thermometers were not graduated alike. We changed them, *vice versâ*, but the results were exactly the same—the escaping air from the open side being always of a higher temperature than the other. Even in the end it was a case of "a man convinced against his will," etc.; for he still maintained that, according to all law (his law especially), the air having the longest travel was bound to be the hottest, and that my line of argument was entirely wrong. He could not say where or why, but he seemed to me to be a firm upholder of the maxim, "Believe nothing you hear and only half of what you see."

If Wrong, Correction Invited.—I readily admit that there is not much advantage in the method I recommend; but there is a saving, as the chimney draught can be reduced, thereby allowing the heat to remain a longer time in the setting. There is likewise a small saving in the first cost. My only regret was, and still is, that the experiment was not made more complete, by measuring the quantity of air passing into each side. With a flame against each inlet, there were indications of a strong pull in both. I think we may reasonably assume the open side must have drawn as much air as, if not more, than the other, notwithstanding the difference in the temperature at the outlets.

One word in conclusion. If I am proved to be right, then I say "Go and do likewise." If I am wrong, I shall be glad to be corrected, so that I may be saved from practising error and teaching it by my example.

1. The *Gas World*.

Discussion.

The President said he understood Mr. Whyte was very anxious to get thoroughly well slated over this business. He hoped the members would let him have his wish.

Mr. D. Terrace, Middlesbrough, said he had very little to do with generator furnaces. He had been mostly accustomed to regenerators. There was a very great difference in the arrangement of the flues between the two. What Mr. Whyte had now carried out in respect of the single travel, as against three or four travels, occurred to him (Mr. Terrace) many years ago. He believed in the theory, but he had not had an opportunity of carrying it out. No doubt if Mr. Whyte had measured the quantity of air passing through the part shown on the left-hand side of the drawing, he would have found a very great difference in the temperature and a greater volume of air passing; but that was heat that was being lost, and that accounted for the difference in the temperature. He believed Mr. Whyte was right in his contention, and was only sorry that he had carried out the matter in an experimental instead of in a practical way.

Mr. C. D. Drury, Sunderland, said he was not quite clear about the furnace with the retorts. He asked whether it was a 5½-inch lining to the furnace.

Mr. Whyte—That is so—30 inches at the top.

Mr. Drury said that in Sunderland they had two old-fashioned retort houses with direct firing, the expense of converting which to the regenerator system would be very great. In another house they had a bench of 12 regenerators, but they had been working only a very short time and he was not in a position to give any information about them. He had no doubt Mr. Whyte was right, to a very great extent. A discussion took place some years ago, when Mr. Valon brought forward his theory about the heating of air. Mr. Herring, of Edinburgh, had adopted very much the same system, the air travelling vertically without any baffles at all. The only question was whether the waste heat from these settings was worth the expense of retaining for heating up the incoming air. If they could put in a regenerator at a fairly low cost, he (Mr. Drury) thought it was the correct thing to do; otherwise, he would heat the air as Mr. Whyte suggested.

Mr. W. Hardie, Tynemouth, asked a question as to the two flues and the air upright. The width seemed to be about an inch. Was that correct?

Mr. Whyte—Quite correct.

Mr. Hardie asked the breadth.

Mr. Whyte—Nine inches.

Mr. Hardie said in one case it was 10 inches.

Mr. Whyte—They are both the same width.

Mr. Hardie said he did not think he could say anything about the paper. He certainly agreed with Mr. Whyte—and it was his (Mr. Hardie's) own practice—that the air supply should be carried straight up to the combustion chamber, as shown by Mr. Whyte. He could understand, roughly, that the air could be heated as easily in a flue going straight up in one course, as in one traveling backwards and forwards; but he could not possibly see how the result in such zigzag flues should be worse than in the other. He could not see where the heat that Mr. Whyte got in one case could possibly be lost in the other.

The fact that the air supply had not been measured was an item of importance, on which the whole thing rested. His own impression was that the flues, as shown by Mr. Whyte, would be exactly equal. Although he used the upright flue himself, he would be very careful about condemning the other.

Mr. H. Tobey, Malton, said he used the same kind of furnaces as Mr. Whyte had shown, in a setting of six. He had also used a furnace which was slightly regenerative. He did not find much difference between the one which was slightly regenerative and the one where the primary air was heated in the manner Mr. Whyte had shown. There was, very probably, not much to be gained by going into an elaborate system of regenerator flues. Referring to Mr. Whyte's experiment, it had been stated by Mr. Hardie that the difference in the quantity of air passing through the different flues accounted for the difference in the temperature. It appeared to him (Mr. Tobey) that in the flue which had no zigzags to it, the quantity passing through that side would be very much greater than through the other. He thought there would be a less quantity of air going through the zigzag than through the open side; the larger the volume of air passed the lower the temperature of it would be, and, therefore, he should have expected that the result would have been exactly the reverse of what Mr. Whyte had arrived at. Such an experiment as that was not quite conclusive unless they measured the air.

Mr. Alex. Allan, Scarborough, said he did not know whether the author of the paper meant that there was no saving in fuel with the zigzag flue as against the straight flue. He had had some little experience with regenerator and generator furnaces, and he knew, from tests very carefully made, that there was a great saving in fuel with the regenerators as against the generators. In some cases, with generator furnaces, he found the fuel consumption about 23 pounds of coke per 100 pounds of coal carbonized, while with the regenerators it worked out at 14 pounds of coke per 100 pounds of coal carbonized. That was with the same class of fuel. With a better class of coal he was using about 12 pounds of coke per 100 pounds of coal carbonized.

Mr. W. Doig Gibb, Newcastle, said he did not know that he had much to say that would interest the members. He thought Mr. Whyte was going on the right lines when he tried, as far as possible, to simplify the arrangement of the flues. He (Mr. Gibb) believed that they would get better results if they strove after a true contact between the air and the hot walls of the flues rather than by rushing the air along a series of more intricate passages. That, he thought, applied both to the air and to the fumes of combustion.

A great mistake was often made by unduly restricting the area of the flues and in arranging matters so that a "rushing" heat was got. No doubt, to the amateur, such looked very pretty, and made it appear as if the works were very busy and were doing extraordinarily good work. But there was no doubt that the lower they could cut the draught down in their furnaces and the slower they could work their air through the air passages and the fumes of combustion through their settings, the better the results they would get. He had, through the courtesy of Mr. Carpenter, seen the settings which had been referred to, at Old Kent Road. There was no doubt they were doing good work, but he thought a word of caution might not be out of place. The system was not so applicable to smaller works, because an outside generator could only work in an economical way when they were running the full number of settings which the generator was built to supply. Therefore there would have to be such a large business for gas as would allow the retorts to be fired or laid off in large sections.

Mr. J. Holliday, Hull, said the question was whether a zigzag flue was necessary to obtain a certain result. Mr. Whyte said he could do the work in a simpler way. He (Mr. Holliday) took it that the whole object of regenerator firing was practically to strip the waste gases of all the units of heat contained in them as far as possible. If they could do that without elaborating their flues, certainly it would be a considerable advantage. They ought to have a certain number of tests to prove whether they were getting the same results with Mr. Whyte's arrangement as with the zigzag arrangement. Unless they had absolutely perfect construction it was impossible to get perfect results; and that was probably where Mr. Whyte had had his trouble. The question was, was it necessary to have a zigzag flue in order to obtain the desired results.

The President thanked Mr. Whyte for the trouble he had been at in coming forward with his paper. Unfortunately, the discussion had been more on the question of generator *versus* regenerator furnaces than on the question of whether it was better to have a chamber in which to heat the secondary air or a zigzag arrangement. As regarded the paper itself, Mr. Whyte seemed to be of opinion that he would require more draught with the zigzag flue than with the chamber arrangement. At one of their works they had had both systems in operation. He had had some experiments made as regarded the draught, and he found the results practically the same in every way, although as regarded the temperature of the waste gases there was less waste in the case of the zigzag flue than with the chamber system. He did not know what was the size of the flues referred to by Mr. Whyte, but from the experiments which he (the President) had made he did not see why there should be more draught required by the zigzag flue, provided the flues were of sufficient area. It seemed to him probable that the reason why Mr. Whyte did not get the results he expected with the zigzag flues was that his flues were too small to admit a sufficient quantity of secondary air and a reasonable amount of draught. As regarded the question of generators *versus* regenerators, although outside the subject of the paper, he might say that the coke sold at his works last year and the year before worked out to practically the same. The coke sold the year before last was 11.29 cwts., while last year it was 11.28 cwts.; and that was after deducting the producer coke and also the coke necessary for the boilers and sulphate plant.

Mr. Whyte, replying on the discussion, said this was no experiment with him, because he had been at work on the matter for seven or eight years. At the present time he had two settings, if not three, in the works with zigzag flues, and he was trying to ascertain whether he was losing or gaining anything as the result. He must say that at the present moment he was a firm believer in the open cavity system, for the

air to travel up as best it might. As regarded the remarks of Mr. Hardie, who could not understand why that result should be, neither could he (Mr. Whyte), and he did not pretend to understand it, but he had simply stated the facts. The man to whom he had referred in the paper, and who was as firm a believer in the principle of the flue as ever man could be, was confident that he (Mr. Whyte) was wrong and that the thermometers were wrong, but the fact remained. The man could not get over that. Why it should be so, he did not know. It certainly seemed mysterious that there should be such a difference. He thought that there would be as much air in the flue passing through the open space as through the zigzag flue. As regarded regenerators, he had had no experience at all. He had nothing to say against them. When the time came for renewals they might go in for regenerators, but at present he did not speak of that at all. The statement that the same results would be obtained in both cases confirmed his opinion; and if they got the same results, he thought it showed conclusively that he was on the right track.

Economical and Safe Limits in the Size of Central Stations.

At the April meeting of the American Institute of Electrical Engineers, Mr. H. A. Lardner read a paper with the above title, in which he gave in connection with the discussion of the subject, much interesting data as to the relative economy of large generating units. In opening, Mr. Lardner said that if the territory is large and the system is to serve several villages or small cities with power for lighting or for railway purposes, one large station located conveniently for coal and water has a decided advantage, owing to economy in labor, lower cost of fuel, water and first cost.

Frequently the business in the individual towns would not be large enough to permit of an independent plant in each, and any risk of interruption to service is put up with because it is the best kind of service that such a community can support. In fact, until the class of territory approaches that of our largest cities, the question of lower first cost and economy of operation must in general rule; for the size of station is not large enough to minimize those advantages or to demand the advantages of a service supplied by several stations, harmoniously designed and operated.

When the territory becomes similar to New York, Chicago, Brooklyn, Boston, etc, the large station has many claims for consideration. As the central stations now built in this class of territory are so much larger than those which have been erected elsewhere, the discussion of the paper was confined to stations for the larger cities, and water power stations were excluded, as they must of necessity be located at the point of development or waterfall, and it is seldom the case that several plants can be built, each large enough to secure the maximum advantages of low cost and low operating expenses, as at Niagara.

The system of distribution which must be used, frequently has a direct bearing on the demand for a large station. Where the distribution pressure is low, as in Edison 3-wire, 120-240-volt systems, there are few if any cities where a sufficient load can be found for a very large station without exceeding the limited zone of economical distribution at this pressure.

Where this system is in operation we find that the stations are generally of high first cost and too small to be operated at the highest economy. The location is necessarily chosen without regard to the water or coal supply, and the load factor is generally very bad, which adds to the expense of operation. As a temporary expedient, at least, rotary converters, transformers and high pressure cables have found a place for connecting together the direct current stations and thus enabling them to exchange power and considerably improve their load factors.

For instance, in New York city the Duane Street Station of the New York Edison Company, with its heavy day load of motors and early evening load of office buildings, has a very different shaped load curve from the Twenty-sixth Street Station or the generating stations formerly located in Thirty-ninth street and Fifty-third street, which delivered their principal service during the evening. However, the double conversion results in losses which should be saved, and still continue the use of uneconomical small stations.

The next step is to establish a large, well located alternating current station and feed the rotaries from the machines there installed. This method permits the use of the largest size of generating units, gives their attendant economies, and the demands of the various sections of a city coming at different hours of the day produces a better load factor.

The generating apparatus installed in the distributing or sub-stations, as they may now be called, can be operated if desirable, for one or two watches during the heaviest loads in their particular sections, and the combination undoubtedly results in greater economy. The existence of these sub-stations with generating apparatus, provides a certain amount of reserve or emergency power which can be called upon, and the danger of concentrating all the generating apparatus in one station is in a measure avoided. The fact of their existence also acts as an incentive to keep down the number of new generating stations and to build one alternating station large enough to meet the entire demands of the system, no matter how large that may be.

The use of the 240-volt incandescent lamp is much more common abroad than with us, and Mr. Lardner considers that a more insistent demand for a 240-volt lamp would be met by our manufacturers and result advantageously. By the use of a 3-wire system and 240-volt lamps, the advantages of 500-volt distribution in copper economy can be obtained, and the zones which can be served from any one station very considerably increased. It is an open question whether with this system of distribution the stations can be made large enough to be built for a fairly low first cost and operated at practically a minimum expense. There is a case in point in Boston, where the Boston Elevated Railway Company has a number of stations ranging from 1,500 to 4,000 kw., and the results of operation are reported to be very low and comparable to the best results which have been shown in much larger stations.

The alternating current system of distribution with primary voltage of 2,200 volts and over, has the ability to serve a very extended territory. With this system of distribution, the question of one large station should not be so important, as the load can probably be divided between two or three stations, each large enough to be economical, and by the use of trunk cables they may aid one another in handling the load and add materially to the safety and continuity of the service.

Mr. Lardner gave the following table of authoriative tests on compound Corliss condensing engines. The best results published, and one near the average, are given for several different sizes:

Pressure.	Vacuum	I.H.P.	Steam.
155	...	1,950	12.5
150	26.9	1,713	12.3
123	25.6	1,592	13.5
133	25.2	1,539	14.1
126	27.0	1,107	14.1
120	...	1,018	13.3
117	...	1,001	16.3
151	...	997	12.8
112	...	709	15.1
144	25.2	741	13.2
159	25.4	595	12.7
90	...	548	13.5

It will thus be seen that under proper conditions of design and operation, very good comparative results can be secured with units much smaller than those installed in the large stations in New York. The published guarantees, for the steam consumption are as follows, in these stations:

Station.	Pressure.	Vacuum.	I.H.P.	Steam.
The New York Edison.....	175	27	5,500	12.5
Manhattan Railway.....	150	26	8,000	13.0
Metropolitan Street Railway.	160	..	4,500	13.14

That part of the cost of labor for engine operation, which varies with the size, amounts to but a small portion of the total operating expenses; and although the larger the unit, the smaller the item becomes per horse power hour, it is relatively of little importance, except in very small units.

The question of floor space required for reciprocating engines of different sizes, demands the largest units practicable. The vertical space required by an engine is provided more cheaply than the floor space, and as the requirements are of three dimensions, the floor area should not increase proportionally with the size of the unit. Again, the aisle space must be practically the same for engines differing in size by large percentages.

In spite of these facts, the floor space in engine rooms per horse power appears to be affected more by the type of engine used and the judgment of the designer than by the size of the unit. The Edison station with engines of 5,500-horse power normal rating require only about one-third of a square foot per horse power and the Metropolitan with 4,500-horse power units, one-half of a square foot per horse power against the 8,000-horse power units in the Manhattan station, with an area of .55 of a square foot per horse power.

It therefore appears that economy of operation and in floor space may be made entirely too much of in discussing the advantages of large units, although with similar design and type of machinery, the large units undoubtedly have some advantages, provided the station is large enough to require a sufficient number of units to permit of economical loading.

The following table gives some published data about the engines in the New York Edison, Manhattan Railway and Metropolitan stations:

Engines.	Metropolitan.	Manhattan.	Edison.
Number	11	8	8 Installed 16 Ultimate
Horse power each normal rating	4,500	8,000	5,500
Horse power each maximum rating.	6,600	12,500	8,000
Aggregate rated horse power	49,500	64,000	88,000
Aggregate maximum horse power	72,600	100,000	128,000

From the large number of units, we may assume that these are the largest machines the manufacturers cared to produce. Larger engines have been built for use aboard ocean liners, and as conditions are in many ways much more severe aboard ship than on land, it should be possible to have still larger units if central station engineers really demanded them. The following data apply to the engines of the *Kaiser Wilhelm der Grosse.*

Two engines, triple-expansion, four cylinders; diameters, 52, 89.7, 96.4, 96.4 inches; stroke, 68.8 inches; piston speed, 885 feet per minute; revolutions, 77 +; steam pressure, 178 pounds; rated horse power of each engine, 15,000.

The steam turbine presents some characteristics which will affect decisions in regard to the arrangement and number of stations for a given system, and although much has been written of them lately, they may be briefly alluded to here. This type of prime mover has decided advantages over reciprocating engines for driving many classes of electrical machines, as it gives ideal conditions for the parallel operation of alternators and synchronous apparatus on account of its uniformity of angular velocity. We are assured that steam turbines run together in parallel with the same facility as hydraulic turbines have always done. It is well known that many difficulties in the operation of 60-cycle apparatus disappear when the supply of power is from water wheels, and if the steam turbines are to help us in this respect it will be a great point in their favor.

There is every reason to believe that the use of superheated steam with turbines will be a comparatively simple matter, as the turbines will have no internal rubbing surface, or cylinder oil. Exhaust steam from turbines being free from oil, may be condensed and returned to the boilers, and this will be an important consideration in many plants now purchasing city water for boiler feed and which find the extraction of oil too difficult and expensive to permit the water being used a second time. Owing to the high speed at which turbines are operated, direct current machines seem to be ruled out on account of commutator troubles.

Perhaps the greatest advantage of the turbine is its economy of floor space. The statement has been made that the Westinghouse-Parsons turbine requires about 80 per cent. of the space needed for the vertical and not over 40 per cent. of that wanted for the horizontal engine. This statement is based on a station layout with a clear space of 7 feet in all directions between machines. This type of turbine being horizontal, requires less head room and consequently a cheaper building by a considerable amount than the vertical engine. Curves given place the required building capacity for turbines at about 50 per cent. of that for vertical engines.

The Curtis turbine of the General Electric Company is of the vertical shaft type, and while it requires more head room than the Westing-Parsons machine, it is very economical of floor space. The following table gives the principal dimensions of some of the sizes which are now being built.

Curtis Turbines and Generators.

Size.	Height.	Diameter.	Floor Space.	R.P.M.
500 k.w.	12 ft. 2 in.	7 ft. 8 in.	46.2 sq. ft.	1,800
1,500 k.w.	16 ft. 10 in.	10 ft.	78.5 sq. ft.	900
3,000 k.w.	22 ft.	14 ft.	154.0 sq. ft.	600
5,000 k.w.	27 ft.	14 ft. 10 in.	175.0 sq. ft.	500

Westinghouse-Parsons Turbines and Generators.

Size.	Height.	Dimensions.	Floor Space.
400 k.w.	7 ft. 6 in.	19 ft. x 5 ft.	95 sq. ft.
1,000 k.w.	8 ft.	43 ft. x 8 ft.	344 sq. ft.
5,500 k.w.	15 ft.	50 ft. x 12 ft.	600 sq. ft.

For comparison the following is the floor space required by the vertical cross-compound condensing engines of a well known maker. The figures include the space required for an alternating-curret generator between the frames:

Size.	Dimensions.	Floor Space.	R.P.M.
500 k.w.	15 ft. x 22 ft.	330 sq. ft.	120
1,000 k.w.	21 ft. x 24 ft.	504 sq. ft.	110
1,500 k.w.	22 ft. x 28 ft.	616 sq. ft.	100
2,500 k.w.	23 ft. x 32 ft.	736 sq. ft.	90
3,000 k.w.	23 ft. x 34 ft.	782 sq. ft.	75

The height in all sizes thus exceeds that of a similar size of vertical turbine.

The steam consumption guaranteed for the above mentioned Curtis turbines are attractive, especially at light loads. The figures are given in dry steam per kw-hour and for purposes of comparison with results per indicated horse power, they have been reduced by assuming an efficiency for generator and turbine of 85 per cent.

Size.	Pressure.	Vacuum.	Pounds Steam per K W. Hour. Full Load.	Pounds Steam per K W. Hour. Half Load	Pounds Steam per I.H.P. Full Load.
500	150	28	20½	23	13
1,500	150	28	20½	22	13
3,000	150	28	20½	21.5	13
5,000	150	28	20½	21	13

The simplicity of the turbine leads us to believe that the high efficiency will not decrease with use nor by reason of lack of adjustment. The method of guaranteeing the efficiency of generators and engines together, will permit this guarantee to be checked more closely than has ever been possible with large engines and generators, on which separate guarantees have been given.

The cost of labor for engine operation will be considerably cheapened with the turbine, and this and the other advantages shown should greatly reduce the necessity for very large units. If, therefore, steam turbines are to make the operation of smaller stations (with a suitable number of units to handle the load economically), equal in efficiency to some of the largest plants now installed, it will be advantageous in many cases to install several stations in place of one, and secure all the savings in distribution and safety against shut-downs that go with such an arrangement.

There are, of course, certain cases where a location cannot be secured convenient to coal and water in more than one place, but these cases are rare. Boston, New York, Chicago and nearly all our largest cities afford opportunities for securing a number of sites, all practically of equal desirability so far as facilities for getting supplies are concerned.

The advantages of large central stations may be summed up from what has been previously said, and consist mainly of the following:

The location of the station on the one most suitable site for the coal and water supply. The reduction of floor space by the use of large units. The economy of fuel secured by the use of large generators and engines. The economy of labor and general superintendence secured by the use of large units in one building. The saving in first cost effected by the installation of a large station with large units. The economy of operation secured by serving many sections of a city with different hours of maximum demand from one station, due to the better load factor obtained.

The installation of a large station presupposes supplying a very large territory from one source, and in order that the coal and water supply may be convenient, the chosen location is generally much further from the load than when it is divided among several plants. This involves a greater expense for a distribution system, although this may be minimized by the installation of high potential current or by local conditions.

The economy of floor space by the use of large units will always be an important consideration where land is valuable, but the economy in this direction with the steam turbine may lead the designer of the future to give less consideration to this point.

The added economy of fuel, labor and general supervision in large units will also be reduced somewhat even with the large turbine units, and the first cost of the machines themselves will undoubtedly decrease per unit capacity with increase in size. However, the reduction in cost of turbine generator installation, from the prices now paid for generators and slow speed reciprocating engines should be considerable and permit smaller units than are now feasible. This will undoubtedly be true after development charges have been cared for.

It is a question whether there is any saving in the first cost in the installation of very large stations, except in prime movers and generators. The construction of double and triple decked boiler rooms, long coal handling apparatus and coal pockets high above the ground, involves

heavy expenditures without compensating advantages. It is probable in the case of some large stations in this city that they could have been built to half their capacity as cheaply per unit as to the ultimate size. The size of the units in either case would probably have been the same.

The principal disadvantage of the very large station is the danger to a system if the disabling of a station leaves the company without a source of power, or takes away a larger portion of its supply than can be cared for by overloading the remaining plants. It is with this point in view that I have attempted to bring out all the points which may make smaller stations worthy of more consideration than they frequently get.

The stations in this city are wonderful examples of good design in all features which tend to make them reliable and free from dangers of serious breakdown and interruption of service. As one designer said in describing his station, it was built to withstand anything but an earthquake or a bombardment. While it may be possible to build such a station, I do not believe that there has been a single station built, and I do not look to see one, which is free from weak points capable of causing interruptions. These features are apparently unavoidable, and while accidents due to them may not do any serious or expensive damage, they may render the building untenantable to employees or to enough of them to cause an interruption to the service.

The recent breakdown at the station of the Niagara Falls Power Company is an instance in point, and while such occurrences have been rare, the one in question left Buffalo without Niagara power for 24 hours, and the Niagara Falls district was without power for nearly two days. I do not think an officer of a large company will look on a like condition without considerable apprehension. The trouble at Niagara is reported to have been started by a lightning storm, which resulted in destroying the cables leading across the bridge from the generator room to the transformer house. Now that it is over, engineers say that there should have been two routes for these important cables, and a number of suggestions may be made to avoid a repetition of the difficulty.

Shutdowns have occurred in some other large stations during the experimental periods of their operation, and while these were doubtless due to poor material or workmanship that had not been weeded out, the failure of material or errors of employees may occur after years of use, and the results are likely to be the same.

Instances occur in this city where cables may be damaged by one cause or another, and the results would not be very different from the Niagara breakdown. Rheostats for the fields of generators may be the weak point in another station; switchboards exposed to flying pieces in another. These weak points can generally be corrected, but the fact is that they now exist and are in my opinion possible sources of trouble.

In conclusion, Mr. Lardner said that he does not advocate a greater refinement than is commercially justifiable, and perhaps this point has been reached by the designers of the large stations; and that smaller stations need not lack many of the advantages of the large ones, and with a number of them in place of one large plant, the necessity for excessive refinement ceases to exist.

The Determination of Benzene in Illuminating Gas.

[By L. M. DENNIS and J. G. O'NEILL, in *Jour. Am. Chem. Soc.*]

In 1891 Hempel and Dennis described a method[1] for the volumetric determination of certain hydrocarbons that are usually present in illuminating gas. Up to that time, all hydrocarbons in this product, with the exception of methane, had been determined by absorption with fuming sulphuric acid and had been classed under the general term "heavy hydrocarbons." It is true that Bunsen[2] gives an analysis of illuminating gas in which the percentages of benzene, ethylene and propylene are stated, but the amounts of these three gases were calculated by means of equations from the results of explosions with air and oxygen, and the calculation was based upon the assumption that the heavy hydrocarbons in the gas consisted only of ethylene, propylene and benzene. It was ascertained by Hempel and Dennis that certain hydrocarbons such as benzene and naphthalene could be removed, in part at least, by means of absolute alcohol, the remainder of the heavy hydrocarbons being then absorbed by fuming sulphuric acid and the methane being finally determined by explosion or combustion. In 1894 Noyes and Blinks adapted[3] the method of Hempel and Dennis to the Bunte burette.

Recent work in this laboratory, however, has shown that while the absorption of benzene by means of alcohol may sometimes give agreeing results, the removal of the benzene is usually by no means complete and the results, at times, show wide variations. The following analyses are given in confirmation of this statement. Air was drawn into a Hempel burette containing water as the confining liquid, and was measured. It was then passed into a gas pipette containing benzene and was drawn back into the burette and the increase in volume noted. The mixture of benzene and air was next passed into a pipette containing mercury and 3 cc. of absolute alcohol, and was shaken for three minutes in contact with the alcohol. The residue was then drawn back into the burette and was passed into a pipette filled with water and was shaken with that liquid for three minutes to remove the vapor of alcohol. The gas was now drawn back into the burette and measured. The results were:

TABLE I.

	I. cc.	II. cc.	III. cc.
Air taken	67 0	50.0	52.2
Air plus benzene (C_6H_6)	73.0	54.0	57.0
After shaking with alcohol	69.0	51.8	54.2
After shaking with water	68.4	51.4	53.7
Benzene taken	6.0	4.0	4.8
Benzene found	4.6	2.6	3.3

Experiments were next tried to ascertain whether repeated treatment with alcohol would remove all of the benzene, and, as will be seen from the table below, it appears that this reagent is unable to remove benzene completely from mixtures of that substance with air.

TABLE II.

	I. cc.	II. cc.	III. cc.	Fresh Absolute Alcohol. IV. cc.	V. cc.
Air taken	58.6	60.1	63.0	56.8	67 9
Air plus benzene	62.8	64.6	67.0	61.0	72.8
After shaking with alcohol	59.8	61.6	63.8	57.8	69.0
After shaking with water	59.4	61.1	63.8	57.6	68.8
After second shaking with alcohol	59.2	....	....	....	....
After second shaking with water	59.1	....	....	....	....
After third shaking with alcohol	59.1	....	....	....	....
After third shaking with water	59.1	....	....	....	....
After passing residue into fuming sulphuric and then into the potasium hydroxide pipette	58.7	60.2	62.9	....	....

It was therefore apparent from these results that for the complete and speedy removal of benzene from illuminating gas some absorbent other than absolute alcohol must be employed.

In 1897 Hofmann and Küspert described[1] certain compounds of hydrocarbons with metallic salts and stated that when illuminating gas acts upon a mixture of nickel hydroxide and aqua ammonia, there results a compound of nickel cyanide with ammonia and benzene, $Ni(CN)_2.NH_3.C_6H_6$. This statement led the authors of the present paper to examine into the action of an ammoniacal nickel solution upon benzene with the view to ascertaining whether a method could be developed for the volumetric determination of the benzene that is present in the form of vapor in gas mixtures. Sufficient of the absorbent to fill a Hempel simple absorption pipette (about 150 cc.) was prepared by dissolving 25 grams of crystalline nickel nitrate, $Ni(NO_3)_2.6H_2O$, in 50 cc. of water and adding 50 cc. of strong aqua ammonia. The solution was allowed to cool, was decanted from any salt that separated out and strong aqua ammonia was then added until the volume amounted to 150 cc. The solution loses its efficiency if diluted with water, and its absorptive power is greatly diminished if nickel hydroxide is present in suspension. The analytical results given in this paper were obtained with the reagent prepared in this manner. Experiments showed that this solution absorbed nothing from air, but that when shaken with a volume of air it gave off a small amount of ammonia gas. In the first series of experiments it was sought to remove this ammonia by passing the gas mixture into a Hempel pipette filled with water, but, since this did not entirely remove the ammonia, it was found necessary to use in place of the water a 5 per cent. solution of sulphuric acid.

Later experiments made in this laboratory by Mr. W. C. Geer have shown that it is possible to prepare the reagent in such manner as to do away with the necessity of the treatment of the gas mixture with dilute sulphuric acid. The method of preparation of the reagent is as follows: Forty grams of nickel nitrate are dissolved in 160 cc. of water to which has been added 2 cc. of nitric acid of specific gravity 1.44. This solution is poured slowly with constant stirring into 100 cc. of ammonium hydroxide, specific gravity 0.908. The resulting deep blue solution is used in the absorption. It has a very slight tinge of lavender. The odor of ammonia is noticeable, but is not strong. The few analyses

1. *Ber. d. chem. Ges.*, 24, 1162.
2. "Gasometrische Methoden," second edition, (1877), p. 142.
3. This Journal, 16, 697.

1. *Ztschr. anorg. Chem.*, 15, 204.

that have been made with the reagent prepared in this manner indicate that it is similar in action to that prepared as above described and that it is equally efficient. It should, however, be more thoroughly tested before complete reliance is placed upon it.

In the series of experiments described in the following pages, the analyses were carried out in a "simple" Hempel burette provided with a water jacket, and water was used as the confining liquid.

Experiments were first made to ascertain whether benzene vapor mixed with air can be quantitatively absorbed by the ammoniacal nickel solution just described. The gas mixture was first passed into a pipette containing the ammoniacal nickel solution and was shaken with that reagent for 3 minutes. It was then drawn back into the burette, passed into a pipette containing mercury and 5 cc. of 5 per cent. sulphuric acid and was shaken for 3 minutes, being then drawn back and measured.

TABLE III.

	I. cc.	II. cc.	III. cc.
Air taken	52.7	48.6	51.3
Air plus benzene	56.4	52.4	55.2
After shaking with ammonical nickel nitrate solution	53.2	49.0	51.9
After shaking with 5 per cent. sulphuric acid.	52.7	48.6	51.3
Benzene taken	3.7	3.8	3.9
Benzene found	3.7	3.8	3.9

The above results show that benzene vapor is quantitatively absorbed by treatment with an ammoniacal nickel solution prepared as above, when the gas mixture is shaken with the reagent for 3 minutes. Results of approximate accuracy can be obtained by using a simple burette without water jacket, but there seems to be a slight heating of the gas mixture resulting from the absorption of the ammonia gas by the dilute sulphuric acid, this rise in temperature being sufficient to cause appreciable error in the final reading. To ascertain whether the time necessary for the absorption of the benzene could be reduced, other mixtures of benzene and air were prepared and were shaken with the absorbent for 1 minute, for 2 minutes, and for 3 minutes. The results, which need not here be inserted, showed that a 3-minute shaking of the gas mixture with the absorbent is necessary for the complete removal of the benzene.

The next point to be ascertained was whether the nickel solution would absorb other constituents of illuminating gas and would so interfere with their determination as to render its use for the absorption of benzene impossible. Measured amounts of carbon dioxide were mixed with measured amounts of air, and this mixture was passed into a pipette containing the nickel solution. As was to be expected, the carbon dioxide was completely removed. It had already been found that the nickel solution had no effect upon air, and consequently the absorption of oxygen in the illuminating gas by this reagent did not need further examination. To ascertain whether carbon monoxide and the unabsorbable residue, consisting chiefly of methane, hydrogen and nitrogen, is affected by the nickel solution, the heavy hydrocarbons were removed from 100 c.c. of illuminating gas by means of fuming sulphuric acid and potassium hydroxide, and the residue was then shaken for 3 minutes with the nickel solution and then with the dilute sulphuric acid. No diminution in volume resulted. From these experiments it appears that the ammoniacal nickel solution beyond removing, wholly or in part, the hydrocarbons other than methane, absorbs no other gas except carbon dioxide, but the fact that this last named gas is removed by the reagent makes it impossible to use the nickel solution for the removal of benzene and allied carbons, and still adhere to the order that is usually followed.[1]

In the customary procedure the hydrocarbon vapors are first absorbed by alcohol, then carbon dioxide by caustic potash, and then the so-called heavy hydrocarbons by fuming sulphuric acid. Hempel and Dennis state[2] that carbon dioxide may not first be removed by means of potassium hydroxide because benzene is soluble in that reagent. Experiments were made to ascertain whether this statement is correct. A measured volume of air was mixed with a measured volume of benzene vapor and this mixture was passed over into a pipette containing potassium hydroxide. No diminution in volume resulted. It therefore appears that the absorption of carbon dioxide by potassium hydroxide may properly precede the absorption of benzene. To be perfectly sure upon this point, however, the following experiment was made: Three Muencke wash bottles containing clear barium hydroxide solution were connected together and illuminating gas was passed through this chain. The carbon dioxide present in the gas was completely removed by the reagent in the first bottle. The gas issuing from the third bottle was, therefore, free from carbon dioxide, but could safely be assumed to contain some of all of the other constituents of illuminating gas; 100 cc. of the gas issuing from the third bottle was drawn off into a Hempel burette and was then passed over into the caustic potash pipette. No decrease in volume took place. A repetition of this experiment gave the same result, and there was thus obtained confirmation of the statement made above, that potassium hydroxide removes nothing from illuminating gas except carbon dioxide.

Experiments were next undertaken to ascertain, if possible, the nature of the hydrocarbons removable by alcohol and by the ammoniacal nickel solution. These hydrocarbons probably consist largely of ethylene, propylene and benzene. Ethylene was prepared by treating pure ethylene bromide with a zinc-copper couple. The purity of the gas was tested by passing it into fuming sulphuric acid, the confining water in the burette having first been saturated with the ethylene. Ten cc. of the gas left a residue of 0.2 cc., showing a purity of 98 per cent. Measured volumes of air were now mixed with measured volumes of this gas and the mixture was then passed into a pipette containing the nickel solution and then into a pipette containing mercury and 5 cc. of 5 per cent. sulphuric acid. The results obtained were:

TABLE IV.

	I. cc.	II. cc.	III. cc.
Air taken	49.2	51.5	48.0
Air plus ethylene	58.0	60.8	54.2
After shaking with ammoniacal nickel nitrate solution	58 8	62.4	55.1
After shaking with 5 per cent sulphuric acid	57.9	60.9	54.2

It, therefore, appearing that ethylene is not taken up by the nickel solution, experiments were next carried out to ascertain whether benzene and ethylene could be separated by means of the nickel solution. The results of these experiments follow:

TABLE V.

	I. cc.	II. cc.	III. cc.	IV. cc.
Air taken	50.2	60.7	48.9	54.4
Air plus benzene	53.0	64.2	51.1	57.2
Air plus benzene plus ethylene	57.6	68.7	57.2	64.4
After shaking with ammoniacal nickel nitrate solution and then with 5 per cent. sulphuric acid	54.7	65.2	54 9	61.6
Benzene taken	2.8	3.5	2.2	2.8
Benzene found	2.9	3.5	2.3	2.8
After shaking the residue with absolute alcohol and then with water	53.4	64.6	54.7	61.1
After treatment with fuming sulphuric acid and then with potassium hydroxide	50.7	61.3	49.7	55.3
Ethylene taken (88 per cent pure)	4.6	4.5	6 1	7.2
Ethylene found by alcohol	1.3	0.6	0.2	0.5
Ethylene found by fuming sulphuric acid and potassium hydroxide after alcohol	2.7	3.3	5 0	5.8
Total ethylene found	4.0	3.9	5.2	6.3
Ethylene taken (corrected volume)	4.04	3.9	5.36	6.3

The results in Table V. show that a satisfactory separation of benzene from ethylene and probably from the other hydrocarbons of the ethylene series may be effected by first shaking the gas mixture with the ammoniacal nickel nitrate solution for three minutes, and then with a 5 per cent. solution of sulphuric acid for the same length of time.

It was hoped that it might be possible to remove the ethylene series of hydrocarbons by means of absolute alcohol before subjecting the illuminating gas to treatment with fuming sulphuric acid. If this were possible, the hydrocarbons would be divided, analytically, into three distinct groups, and a much clearer idea of the illuminants in the gas could then be obtained from the results of a volumetric analysis than is possible under the present methods. The results in Table V. have shown that the absorption of ethylene by alcohol is far from complete, and, moreover, that the results of such absorption are by no means constant. It was thought desirable, however, before abandoning the separation by alcohol to try the method with illuminating gas, and in Table VI. the results of these experiments are given.

TABLE VI.

	I. cc.	II. cc.	III. cc.	IV. cc.
Carbon dioxide	1.2	1.2	1.1	1.1
Benzene by nickel solution and dilute sulphuric acid	1.2	1.0	1.0	1.0
Hydrocarbons removed by absolute alcohol and water	1.5	0.3	1.3	0.5
Heavy hydrocarbons removed by fuming sulphuric acid and potassium hydroxide	2.3	3.5	2.6	3.4
Total hydrocarbons absorbed by the 3 reagents.	5 0	4.8	4.9	4.9

These results demonstrate conclusively that absorption by alcohol

1. Hempel-Dennis's "Gas Analysis," 1902, p. 282.
2. *Ibid*, p. 281.

cannot be employed for the purpose in hand and that at the present time the gas analyst must content himself with the absorption of benzene by the nickel solution and the subsequent absorption of the so-called heavy hydrocarbons by fuming sulphuric acid. In Table VII. are given four analyses of illuminating gas, showing the accuracy of the determinations of carbon dioxide, benzene, and the heavy hydrocarbons.

TABLE VII.

	I. cc.	II. cc.	III. cc.	IV. cc.
Carbon dioxide	1.2	1.2	1.2	1.2
Benzene by nickel solution and dilute sulphuric acid	1.0	1.0	0.9	0.9
Heavy hydrocarbons removed by fuming sulphuric acid and potassium hydroxide	4.0	3.9	3.9	4.0
Total hydrocarbons	5.0	4.9	4.8	4.9

Before the ammoniacal solution of nickel nitrate and the 5 per cent. solution of sulphuric acid are used for the absorption of benzene, the reagents should, of course, be saturated with the other constituents of the gas mixture in the usual manner.[1] If the reagents in the pipettes have been used for analysis of illuminating gas, they should not be used in the examination of generator gas or of any other gas mixture differing appreciably from the illuminating gas, for the gases that have been dissolved by the reagent when it was shaken with the illuminating gas would escape into another superimposed gas mixture, if the latter did not contain these dissolved gases at approximately the same partial pressure as that at which they existed in the gas with which the reagent was first shaken. Consequently the gas pipettes should be filled with fresh solutions of ammoniacal nickel nitrate and sulphuric acid whenever the gas mixture to be analyzed differs markedly from that for which the reagents had previously been used.

The results may be briefly summarized as follows:

(1) Under the described conditions, alcohol does not completely remove either benzene or ethylene from gas mixtures.

(2) The use of an ammoniacal solution of nickel nitrate furnishes a rapid and exact method for the determination of benzene in mixtures of that substance with air and ethylene, and in coal gas.

The authors would recommend that in the analysis of illuminating gas (coal gas), the order of procedure be: (*a*) The absorption of carbon dioxide by potassium hydroxide; (*b*) the absorption of benzene by the ammoniacal solution of nickel nitrate above described; (*c*) the absorption of the "heavy hydrocarbons" by fuming sulphuric acid; (*d*) the absorption of oxygen by alkaline pyrogallol or by phosphorus; (*e*) the absorption of carbon monoxide by cuprous chloride; and (*f*) the determination of the methane and hydrogen.

The authors have been unable to try this new method on any commercial gas mixture other than the local supply of illuminating gas. They would therefore earnestly request chemists using the method on other gas mixtures to communicate to them the results of such analyses and call their attention to any difficulties that may arise.

1. Hempel-Dennis's "Methods of Gas Analysis," (1902), p. 119.

Points in the Design of a Power Plant.

[By MR. W. H. BOOTH, in *Elec. Review.*]

The operation of designing a power plant involves many considerations, and a considerable amount of study and calculation, if the result is to be something better than a mere heterogeneous collection of samples of mechanical engineering fortuitously gathered under one roof, and lacking in proportion, form and fitness for the particular case in hand. The basis of design is, of course, the amount of power required, and it is necessary to provide that the maximum demand for power shall be met by every detail of the plant. To insure that this shall be secured with a minimum of expense is one of the main objects of the designer.

An analysis of the plant which must or may be employed gives the following items of the first class: (1) Boilers; (2) steam engines and condensing plant; (3) generators (4) accumulators.

Of the second class of apparatus there are: (1) Feed pumps; (2) feed heaters; (3) water coolers; (4) stoking machines; (5) coal and ash conveyors.

In a third class may be placed tanks, reservoirs, wells and other incidentals.

Commencing with the boilers, it is at once obvious that they must supply the maximum steam demand. In a traction station this demand is steady and uniform, the variations of the load being too rapid to affect the boilers, especially if these are of large water capacity.

In a lighting station there are several courses open. The boilers may be sufficient to give the maximum peak load when it comes on. If fitted with forced draught, they can be forced to their maximum output at such times. If only fitted with natural draught, this, during a fog, may be at its worst when the demand for current is greatest, and an excess of boiler power must be laid down.

If accumulators are used to get over the peak of the load, this will reduce the necessary boiler plant considerably, and the effect of accumulators will thus extend to boilers, feed heaters, pumps, and to all the items of class 2, in fact, as well as to engines. In a traction station, however, the use of accumulators will only extend its influence directly to the engines and generators, though it will indirectly affect the boilers, because it will render it more economical to work the engines, *i. e.*, at steady load instead of at widely varying loads.

If liable to be called on for sudden flushes of steam, the firing of boilers may be done with liquid fuel at the heavy points, and the output of steam may thus be instantaneously increased or diminished with ease. It may even be desirable to employ water tube boilers of the small tube type, which hold very little water, and may be started up from cold water and put under full steam in a few minutes.

The steam engines must be provided to take the maximum load with a very little reduction of speed. They will consume steam according to their load factor, and this will depend upon the nature of the load. The power to be supplied in a lighting station will vary according as whether accumulators are provided or not; but in a lighting station the number of engines will always be greatly in excess of the mean load requirements, unless the accumulators are very much in excess of anything yet attempted.

In a traction station a poor load factor may render it desirable to use simpler engines than are justified when the load is steady. Only when the engines are decided upon can their steam consumption be arrived at and the boilers designed. The generators will be designed similarly to the engines, with due regard to the use of accumulators. When accumulators are employed so that the output of current is even and regular, a generator cannot be run at such an output as it will give as a maximum where there are no accumulators, for it would become overheated at the constant load. As far as possible the generator should be capable of such an output as will stop the engine; the engine ought not to be capable of burning out the generator. Accumulators serve in a lighting station to cut off the sharp peak of the maximum load, and in a traction station to reduce the load curve to a level line; they affect the engine by enabling it to be run at its constant economical load, and they reduce the whole of the plant in proportion to the economy thus secured.

Thus, the items of class 1 are all mutually inter-independent and must first be designed, the items of class 2 being provided in accordance with the boilers decided on. The items of class 3 are to be considered separately, and depend upon local circumstances, such as the presence of a canal, a river or a sufficient area for storage, as well as upon hydrogeological conditions. By carrying through a design with and without accumulators, may be ascertained the economy of these, most certainly remembering to bring into the equation the buildings affected, and to take into account every factor.

In favor of accumulators there are to be placed a less cost of plant throughout, and a reduced cost of coal, water, oil and stores, depreciation and maintenance, while against them are the interest charges, depreciation, maintenance and general expeness of the accumulator itself, any buildings to house the accumulator being much less costly than the savings in the main buildings of the boiler house or engine room.

The design of plant thus far has not been considered in respect of types to be employed. Of engines there are the low and high speed, as well as horizontal, vertical or combination types. There are various types of boilers to be selected from, and the question of buildings is always thus closely allied to that of plant. Though the working of the plant must usually be accorded first place in arranging the buildings on a given site, the erection of the plant should receive every possible thought in respect of convenience of access for delivery of heavy boilers and machinery. A heavy boiler may well be carried through an empty engine room, but this method would afford poor satisfaction when the station was at work and a new boiler had to go the same way.

It is poor economy not to provide from the start a solid road for carts and lorries to bring plant to the delivery point, and when possible the loads should be capable of being brought under the engine room traveler.

The buildings should thus be laid out with all these points in view, so that they may receive the maximum consideration consistent with ultimate economy of working costs.

Generally the process of design must start from an assumed load curve. This can usually be approximated from a similar existing plant. The

lighting station and the traction station offer the two extreme types of load. In the lighting station there is little or no load during daylight hours, and this is easily carried by a small set of machinery or is worked from the accumulator. As darkness sets in the load comes on with great rapidity, runs up to a peak of brief duration and declines as rapidly. Unless a battery is provided to give out a large output for an hour or two there must be provided engines and boilers sufficient to give the maximum output even for only a few minutes' duration of the sharpest peak of the load curve. The plant necessary to work for anly these few minutes may be quite a large fraction of the whole mechinery. Yet it will remain idle except for these few minutes. These considerations, therefore, point to the use of special fuel to urge the steam production over the critical period even at much enhanced cost. Oil and other liquid fuels are specially suitable for this purpose. So also is artificial draught, while the engine plant will be minimized by wasteful rates of expansion duridg maximum load periods, not forgetting, however, that too wasteful engine running implies a bigger demand on the boilers. The accumulator offers itself as the best means of reducing the machinery installed, for it can be run at maximum output over the peak of the load, and it will carry the day load without running on the engines, or, if a day load is run off an engine, the surplus current can be run into the battery.

The traction load is quite different. The full load soon comes on, and it continues very even for the whole day, and falls to zero quickly as the cars are shedded at night. But the load curve varies rapidly from maximum to minimum every few seconds, and the duty of a battery in such a station is to equalize these variations.

As the mean load of a small station may be, say, 20 per cent. only, it appears that the engine may be reduced to about a fourth of the maximum power of a non-battery station. Engines work so very much more economically under steady load than when running at a mean load only a fifth or a fourth of maximum, that half the fuel may be saved by using accumulators, and this will cut the boiler costs in two and all other co-ordinate expenses.

In regard to more detailed design, the foregoing being considered general or proportional, the question of arrangement comes in.

Coal can rarely be delivered at such a height that it will gravitate from the bunkers to the machine stokers. These machines are not advisable when the coal must be lifted by hand into hoppers, and if hand firing is decided upon, it will often be easy to tip the coal direct to the bunkers from carts or railway trucks. Hand fired boilers should be allowed sufficient space in front to permit of the use of a 10 foot rake by a man standing behind the rake, and there should be room enough behind the man for a fair heap of coal outside the bunker. Less room may serve with machine stoking, but in any case it is bad policy to reduce this space to a possible minimum, and it is not desirable to place boilers to face each other with a common floor space between, if this can be avoided. Mechanical stokers should be supplied with coal by travelers from bunkers above. Where the bunkers are in front of the boilers, each boiler may be supplied by its own light coal conveyor delivering to the hopper. If the coal must come from the end of the house, one traveler may be arranged to tip into all the hoppers, the tipping latch being put out of action automatically as the hoppers fill up, and the speed of the conveyor being regulated so that an occasional bucket remains untipped and returns to the bunkers. If, however, the conveyor carries ashes on its return journey, the condition of the last hopper may be made to determine whether the conveyor shall rest awhile. Where bunkers of large capacity are placed sufficiently high to feed all hoppers, the conveyor will simply carry all coal from the point of entry by cart, etc., to such bunkers, whence it is now usual to weigh it automatically to the stokers.

The removal of ashes may also be automatic if there is sufficient cellerage. Thus at the Shepherd's Bush Station of the Kensington and Knightsbridge Company, Mr. Miller has arranged a Graham & Morton conveyor underneath the line of boiler furnaces. There are chain grate stokers which deliver clinker and ash behind the bridge wall or dumping plate into a deep hopper pit, which terminates in a cast iron rectangular trunk or spout about 9-inches square, closed by a partly balanced valve. When sufficient clinker has accumulated, the valve door opens, and the clinker falls upon the conveyor, and the valve then automatically closes.

Hand-fired Lancashire or other boilers could be similarly arranged as regards a conveyor below, if the hearth pit bottom was carried down for the purpose.

Specially to be avoided is the agitation of coal in such a manner as to cause it to fall through the air any distance at all, whereby the air becomes dust laden by the winnowing action which takes place.

In arranging boilers in long banks, unless it seems desirable to have one or more passageways between, any number of Lancashire boilers may be placed as close together as necessary.

It is not desirable to place water tube boilers other than in pairs, with a passageway between each pair. The space is necessary for the purpose of vision through the sight holes to the furnace, and for introducing steam brush for tube cleaning. This extra floor space must be duly considered when weighing up the floor space required by different types of boiler.

The position of the economizer is to be fixed upon. It or they may be placed parallel with the boilers and in the space that would be occupied by an additional boiler. The by-pass flue may run either at one side of or below the economizer, as space demands.

In Lancashire practice the main flue often runs across the end of the boilers, and the economizer is placed behind and parallel with it, the chimney being in line with the main flue; or there are two economizers on either side of the chimney, which stands in the center of the main flue, or just behind it. Subject to other circumstances, of course, the flues ought to be as short and direct as possible.

Where Lancashire boilers are employed with superheaters behind, these must be so arranged that they can be cut out of the path of the hot gases and fully opened for inspection.

Special care ought to be exercised in so arranging a superheater in the back downtake of Lancashire or similar boilert that the hot gases really do travel between the pipes, and are not left to find their way more or less fortuitously between them.

With ordinary smoke producing boiler settings the efficiency of a superheater will be much impaired, but when good settings are adopted and combustion is perfect the superheater will become too hot at times, and it may be advantageous to provide dampers to compel a part only of the gases to pass through the superheater, the remainder going direct to the flues.

When less steam is passed through the heater and mixed with saturated steam this system of regulation does not relieve the superheater of its excessive temperature exposure. The separate damper enables this to be done.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

AT the annual meeting of the Detroit City (Mich.) Gas Company no change was make in the personnel of the official management; neither was a dividend declared. The Directors elected were: Emerson McMillin, Thos. H. Hubbard, John Byrne, F. S. Smith, W. F. Douthirt, G. H. Russell, W. J. McMillan, M. W. O'Brien, John C. Donnelly, D. M. Ferry, A. C. Angell and Eugene T. Lynch. The Directors subsequently perfected the following executive management: President, Emerson McMillin; Vice-President, W. C. McMillan; Treasurer, M. W. O'Brien; Secretary and General Manager, Paul Doty.

L. R. BRADY, writing from Pittsburg, Pa., under date of the 8th inst., says: "I do not suppose artificial gas manufacturers as a rule care for information respecting what has been done and is doing in the reaping and supply of natural gas, but at a venture I will send you the following from the last annual report of the Board of Directors of the Philadelphia Company for the year ended March 31, 1903. The report shows that during that twelvemonth 12 wells were purchased and 85 wells were drilled, of which 67 were productive of gas, 8 of oil and 10 unproductive; 20 wells were sold and 54 abandoned, having ceased to be productive, making the total number of wells owned and controlled through stock ownership, and in use by the Company at this date, 516.

"'During the year 82.58 miles of pipe were reclaimed and 160.72 miles were laid. The total amount of pipe lines operated by this Company, either through ownership or stock ownership in other corporations, is now 1,334.88 miles of the following sizes: Twenty seven miles of 36-inch pipe, 13 miles of 30-inch pipe, 35 miles of 24-inch pipe, 74 miles of 20-inch pipe, 127 miles of 16-inch pipe, 63 miles of 12-inch pipe, 99 miles of 10-inch pipe, 242 miles of 8-inch pipe, 268 miles of 6 inch pipe, 386.88 miles of 5-inch pipe and smaller. This does not include the 134.31 miles of mains of the Allegheny Heating Company, nor the 335.42 miles of mains of our several artificial gas companies. The Company now holds under lease 289,500$\frac{3}{10}$ acres of gas and oil territory situate in Western Pennsylvania and West Virginia. It controls through its ownership of the Union Gas Company, of McKeesport, 398$\frac{1}{2}$ acres, and through its majority of ownership of the Equitable Gas Company, 1,140 acres of leaseholds. The Company has acquired during the year 105,725$\frac{7}{10}$ acres of productive gas territory. By surrenders of unproductive and exhausted leases, it has reduced its previous holdings so that the total increase in acreage during the year is 87,967$\frac{7}{10}$ acres.

The Company sold during the year 28,285,102,350 cubic feet of gas, being an increase of 4,400,160,350 cubic feet, with additional receipts from that source of $581,041.66. There has been an increase during the year of 6,855 domestic consumers of the natural gas supplied by the Company and the Companies it operates. The Philadelphia Company and the Companies it operates supply 41,890 natural gas consumers, and the Allegheny Heating Company supplies 12,851 consumers.'"

THE Newport (Tenn.) Gas Company has been incorporated with a capital of $25,000. The officers of the concern are: President, Crawford West; Vice-President, Gustave Jones; Secretary, J. L. Jones; Treasurer, J. M. Jones.

A CORRESPONDENT in Atlantic City, N. J., writing under date of the 9th inst., says: "In further reporting the status of the case of the estate of Mary King, against the Atlantic City Gas and Water Company, which case was noted recently in the JOURNAL, I may say that the Company has been advised by its counsel that the estate has consented to a reduction of the damage verdict ($3,000) to $800, and has agreed to accept the lesser sum in full release. The Company, believing that it is not liable at all, will carry the case to a higher court, by whom the matter may be considered strictly on its legal merits."

HERE is a story of a "kick" from a consumer of the Citizens Gas Company, of Jacksonville, Fla., which seems to us to possess all the elements of novelty; "A great deal of gas escaped last month while placing the pipes for the houses on opposite side of the street; I suppose that is the cause of our bill being so high. I think you ought to allow for that waste, and take it off the bill. Yours respectfully, Mrs. C. M. B * * * n, 2 * 1 Clay street."

A CORRESPONDENT in Lansing, Mich., incloses the following: "Some days ago, President B. G. Dawes, of the Lansing Gas Light Company, Rufus Dawes and D. S. Milne, Consulting Engineer, were in this city, counseling with Secretary Walker over plans and projects for increasing the output of the Company and the improvement of its service in general. The present high prices asked for structural ironwork and the difficulty of obtaining the same, together with the high prices of building materials, compel them reluctantly to abandon their original intention of erecting a complete gas plant on the new site at the foot of Pine street, north. However, very material improvements will be made to the present facilities for manufacturing and distributing the product, and the Company's patrons will be assured of first-class service. Another difficulty confronting the management is in getting cast iron pipe for the proposed gas main extensions. All reasonable means are being taken to hurry the matter along, but as yet not a foot has been received. When the material arrives on the ground, the Company will employ a large force of men in laying it. The prospective customers are naturally getting somewhat restless under the unusual delay and some are unjustly inclined to blame the Gas Company for something entirely out of their control. Mr. Dawes expressed himself as more than pleased with the city's evidences of prosperity and future prospects."

THE Calumet (Mich.) Light, Heat and Power Company has been organized by Messrs. Paul F. Roehm, John Burder and A. W. Kerr to conduct a central heating plant for the distribution and sale of heat and in connection therewith an electric plant for light and power. The capital of the company is $80,000. Light and power are now supplied to all Houghton county cities and towns by the Houghton County Electric Light and Power Company, with main plant and headquarters at Houghton. Control of this Company was recently obtained by the eastern capitalists who own the street and interurban electric railway in Houghton county. Further opposition to this concern will come from the erection of a central gas plant at Lake Linden.

MR. WILLIAM M. LEWIS, Superintendent of the Somerset Lighting Company, of Somerville, N. J., reports that some time ago one of the neighboring gas companies had inserted in the local newspapers the following advertisement, which seemed to take very well:

"The Smile That Won't Come Off"
is on every woman's face who uses
A Gas Range.
If you are "Force"-d to get a meal
all "Uneeda" do is
turn a valve and say
"Presto!"——"That's all."

JUDGE ERDMAN has refused the application of Thomas W. Heins and Joseph Ward, Jr., to put the affairs of the Monroe County Gas Company, of Stroudsburg, Pa., in the hands of a receiver.

THE employees of the Champaign and Urbana (Ills.) Railway, Gas and Electric Company recently received checks amounting to 5 per cent. of their salaries for the past year. The Company's business is in a very flourishing condition.

MR. A. L. BARTH is informed that the Sherman (Tex.) Gas Light and Fuel Company is controlled by eastern capitalists, whose headquarters are in Augusta, Me.

THE Rome (Ga.) gas works were sold some days ago under decree issued by the United States Circuit Court. The property was purchased by Mr. John M. Kennedy for the bondholders, all of whom are residents of Cincinnati. The price paid was $18,500.

MR. W. C. BOYLE, President of the Salem (O.) Gas Light Company, has secured a temporary injunction restraining the Salem authorities from enforcing an ordinance under which the selling rate is put at $1 per 1,000 cubic feet, for 10 years from June the 1st prox. The Company is willing to accept a net rate of $1.15.

THE Lapeer (Mich.) Council has granted a 30-year franchise for a gas plant in the city, fixing the rates at $1.50 for illuminating and $1.25 for fuel gas. One of the men to whom the franchise is granted is George T. Hargreaves, editor of the *Press*.

Two changes were made in the Directorate of the Cincinnati Gas and Electric Company at the annual meeting of the stockholders. M. E. Ingalls, President of the Big Four Railroad, and George Bullock, President of the Bullock Electrical Manufacturing Company, retired, and Morris M. White, President of the Fourth National Bank, and William Cooper Procter, of the Procter & Gamble Company, were elected to succeed them. Mr. Ingalls declined to accept further service as a Director, as he desires to give his time to his railroad duties and also to the Merchants National Bank, of which institution he was recently elected President. Business pressure is also given as the reason for the declination of Mr. Bullock to serve further. Another reason for Mr. Bullock's retirement is that he is a Director in the National Lafayette Bank, five of whose Directors, including himself, are Gas Company Directors, and he deemed it wise to retire. The other Directors were re-elected, as follows: Andrew Hickenlooper, Stephen R. Burton, J. T. Carew, Briggs S. Cunningham, William A. Goodman, R. A. Holden, Jr., A. Howard Hinkle, Norman G. Kenan, M. E. Moch, Casper H. Rowe, Charles P. Taft, J. B. Foraker, Jr., J. G. Schmidlapp. The stockholders also ratified the action of the Directors in recommending an increase of $2,000,000 in the capital stock of the Company. This makes the total capitalization $31,000,000, the paid-in capital to date being $29,000,000. This new stock is to be used in making extensive improvements, especially in the West End gas works, which is to be entirely rebuilt and raised to a height which will place it above flood water interference under 71 feet. The stock will not be issued at once, and will be retained in the treasury to "be disposed of at such times and upon such terms as the Directors may from time to time direct." In his annual report of the condition and operation of the Company, President Hickenlooper submitted a mass of data and figures showing an increase in the consumption of gas equal to 15 per cent. and 20 per cent. for electricity. During the year $700,000 was expended on improvements, including conduits, the new addition to the Plum street generating station and other improvements. This station is about ready for its electrical machinery, and he expects to spend $500,000 for machinery alone during the coming year. At the present percentage of increase in the demand for gas and electricity the plants will soon be worked to their maximum, and the improvement in the electrical department, which is drawing to completion, is needed. In the improving of the West End gas works the capacity of the plant is to be trebled.

MR. HOWARD OLDS, for the past 5 years Superintendent of the City of Lincoln (Ills.) Gas Company, has been elected a Director of the Company. As the growing business demanded his entire time he has given up the Superintendency of the Union Gas and Electric Company, of Bloomington, Ills., after two years there of successful work. On his leaving Bloomington the men at the works presented Mr. Olds with a handsome Morris chair, done in leather.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, MAY 18, 1903.

The Market for Gas Securities.

The market for city gas shares was narrow, dull and lower during the week, purchasers for long account seemingly being disposed to pay undue heed to the vetoing of the Remsen bill. By-the-way, our reference to this measure last week was in error, when we stated that the Governor was likely to sign the bill over the Mayor's objections. Unfortunately the bill is one which does not go again to the Governor for his consideration. Consolidated closed to-day (Friday) at 205½ to 206, which is a loss for the week of 3 points. It looks a purchase to us.

Brooklyn Union remains inert. It closed to-day at 207 to 215, ex-div. of 2 per cent. Peoples, of Chicago, is also on the declining list, although some fair lots were taken during the week by purchasers who usually know what they are doing. Washington gas is off quite a bit, on the understanding that the scrip dividend will not exceed 100 per cent. Baltimore gas is firm, and Detroit City sold off when it became known that no dividend was declared at the annual meeting.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MAY 18.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	205½	205
Central Union, Bonds, 5's.	3,000,000	1,000	109	111
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	310	325
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	108½	109
Northern Union, Bonds, 5's.	1,250,000	1,000	104	107
New York and East River ..				
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	132½	140
Preferred	5,000,000	100	152	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	115½	118
Yonkers	299,650	500	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	207	215x
" " Bonds (5's)	15,000,000	1,000	119	119½
Bay State	50,000,000	50	⅜	½
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	7	10
" " Bonds, 5's	5,256,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central, San Francisco	900,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	97½	98
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	103	106
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	70	71
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	85	87
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	77	79
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	80	85
" Bonds, 6's	2,650,000	..	105	107
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	97	105
Preferred	2,500,000	100	100	110
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	.
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101½	101½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	51½	52
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	95	96½
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	800,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	94
Syracuse, N. Y.	1,975,000	100	42	45
Bonds	2,047,000	1,000	98½	99½
Washington, D. C	2,500,000	20	440	445
First mortgage 6's	600,000	..	..	..
Western, Milwaukee.				
Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, Brevard, N. C. 792
Baxter & Young, Detroit, Mich. 792
David Leavitt Hough, New York City. 792
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 784
Frank D. Moses, Trenton, N. J. 779
Fred. Bredel Co., Milwaukee, Wis. 780
Geo. R. Rowland, New York City. 784
Humphreys & Glasgow, New York City. 793
Kerr Murray Mfg. Co., Fort Wayne, Ind. 792
The Gas Machinery Co., Cleveland, O. 779
The Jeffrey Manufacturing Co., Columbus, O. 789
The Western Gas Construction Co., Fort Wayne, Ind. 800
United Gas Improvement Co., Philadelphia, Pa. 797
Wm. Henry White, New York City. 795

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, Brevard, N. C. 792
Bartlett, Hayward & Co., Baltimore, Md. 793
Baxter & Young, Detroit, Mich. 792
Christopher Cunningham, Brooklyn, N. Y. 789
Connelly Iron Sponge and Governor Co., New York City 784
Continental Iron Works, Brooklyn, N. Y. 794
Davis and Farnum Mfg. Co., Waltham, Mass. 792
Deily & Fowler, Philadelphia, Pa. 796
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 784
Frank D. Moses, Trenton, N. J. 779
Fred. Bredel Co., Milwaukee, Wis. 780
G. Shepard Page's Sons, New York City. 792
Humphreys & Glasgow, New York City. 793
Isbell-Porter Company, New York City. 794
Kerr Murray Mfg. Co., Fort Wayne, Ind. 792
Lloyd Construction Co., Detroit, Mich. 782
Logan Iron Works, Brooklyn, N. Y. 796
Quintard Iron Works, New York City. 793
R. D. Wood & Co., Philadelphia, Pa. 794
Riter-Conley Mfg. Co., Pittsburg, Pa. 795
Stacey Mfg. Co., Cincinnati, O. 795
The Connersville Blower Company, Connersville, Ind. 797
The Gas Machinery Co., Cleveland, O. 779
The Jeffrey Manufacturing Co., Columbus, O. 789
The Western Gas Construction Co., Fort Wayne, Ind. 800
United Gas Improvement Co., Philadelphia, Pa. 787

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. 793
B. E. Cholar, St. Louis, Mo. 782
Economical Gas Apparatus Construct'n Co, Toronto, Ont. 784
Humphreys & Glasgow, New York City. 793
The Gas Machinery Co., Cleveland, O. 779
The Western Gas Construction Co., Fort Wayne, Ind. 800
United Gas Improvement Co., Philadelphia, Pa. 787

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N. Y. 794
Kerr Murray Mfg. Co., Fort Wayne, Ind. 792
Logan Iron Works, Brooklyn, N. Y. 796
R. D. Wood & Co., Philadelphia, Pa. 794
Riter-Conley Mfg. Co., Pittsburg, Pa. 795
The Gas Machinery Co., Cleveland, O. 779
The Western Gas Construction Co., Fort Wayne, Ind. 800

PRODUCER POWER PLANTS.

R. D. Wood & Co., Philadelphia, Pa. 794

TAR AND CARBONIC ACID EXTRACTOR.

The Gas Machinery Co., Cleveland, O. 779
The Western Gas Construction Co., Fort Wayne, Ind. 800

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich. 777
The Gas Machinery Co., Cleveland, O. 779
The Western Gas Construction Co., Fort Wayne, Ind. 800

GAS METERS.

American Meter Co., New York and Philadelphia. 799
Detroit Meter Company, Detroit, Mich. 799
D. McDonald & Co., Albany, N. Y. 797
Helme & McIlhenny, Philadelphia, Pa. 799
John J. Griffin & Co., Philadelphia, Pa. 760
Keystone Meter Co., Royersford, Pa. 798
Maryland Meter and Mfg. Co., Baltimore, Md. 798
Metric Metal Co., Erie, Pa. 790
Nathaniel Tufts Meter Co., Boston, Mass. 798

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia. 799
D. McDonald & Co., Albany, N. Y. 797
Helme & McIlhenny, Philadelphia, Pa. 799
John J. Griffin & Co., Philadelphia, Pa. 760
Keystone Meter Co., Royersford, Pa. 798
Nathaniel Tufts Meter Co., Boston, Mass. 798

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn. 780

GAS AND WATER PIPES.

Charles Millar & Son Co., Utica, N. Y. 784
Christopher Cunningham, Brooklyn, N. Y. 789
Donaldson Iron Co., Emaus, Pa. 784
M. J. Drummond & Co., New York City. 781
R. D. Wood & Co., Philadelphia, Pa. 794
Warren Foundry and Machine Co., New York City. 784

SPECIALTIES FOR OIL AND PIPE LINES.
S. R. Dresser, Bradford, Pa..... 781

GAS MAIN STOPPERS.
Safety Gas Main Stopper Co., N.Y. City..... 784

GAS TAPPING MACHINES.
George Light, Dayton, O..... 784
H. Mueller Manufacturing Company, Decatur, Ills..... 781

GAS COALS.
Berwind-White Coal Mining Co., New York and Phila.. 790
Perkins & Co., New York City..... 790
Westmoreland Coal Co., Philadelphia, Pa..... 791

CANNEL COALS.
Perkins & Co., New York City..... 790

STOKING MACHINERY.
G. A. Bronder, New York City..... 777

AUTOMATIC WEIGHING MACHINERY.
Richardson Scale Co., New York City..... 780

CONVEYORS.
C. W. Hunt Company, New York City..... 781
G. A. Bronder, New York City..... 777
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 792
The Gas Machinery Co., Cleveland, O..... 779
The Jeffrey Manufacturing Co., Columbus, O..... 789
The Link-Belt Machinery Co., Chicago, Ills..... 791
The Western Gas Construction Co., Fort Wayne, Ind... 800

CHARGING BARROWS & COAL WAGONS.
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 792

GAS ENRICHERS.
Gulf Refining Co., Pittsburg, Pa..... 790
Standard Oil Co., New York City..... 751
The Sun Oil Co., Pittsburg, Pa..... 791

COKE CRUSHERS.
C. M. Keller, Columbus, Ind..... 791
The Jeffrey Manufacturing Co., Columbus, O..... 789

STEAM BLOWER FOR BURNING BREEZE.
The Connersville Blower Company, Connersville, Ind... 797

ECONOMIZERS.
Green Fuel Economizer Co., Matteawan, N.Y..... 782

GAS GAUGES.
The Bristol Co., Waterbury, Conn..... 789

GAS GOVERNORS.
Connelly Iron Sponge and Governor Co., New York City 783
Isbell-Porter Co., New York City..... 794
R. D. Wood & Co., Philadelphia, Pa..... 794

CEMENTS.
C. L. Gerould, Galesburg, Ills..... 788

RETORTS AND FIREBRICKS.
Adam Weber Sons, New York City..... 788
Baltimore Retort and Firebrick Co., Baltimore, Md..... 788
Brooklyn Firebrick Works, Brooklyn, N. Y..... 788
Henry Maurer & Son, New York City..... 788
James Gardner, Jr., Co., Pittsburg, Pa..... 788
J. H. Gautier & Co., Jersey City, N. J..... 788
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 788
Missouri Firebrick Co., St. Louis, Mo..... 788
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 778
The Kreischer Brick Mfg. Co., New York City..... 788

INCLINED RETORTS.
Adam Weber Sons (Graham, Morton [England] System) 788
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 783

VERTICAL S'S.
Adam Weber Sons (Oscar B. Weber's Construction)..... 788
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 783

REGENERATIVE FURNACES.
Adam Weber Sons, New York City..... 788
Bartlett, Hayward & Co., Baltimore, Md..... 793
Fred. Bredel Co., Milwaukee, Wis..... 780
J. H. Gautier & Co., Jersey City, N.J..... 788
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 788
Missouri Firebrick Co., St. Louis, Mo..... 778
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 778

SELF-SEALING MOUTHPIECE DOORS.
Continental Iron Works, Brooklyn, N.Y..... 794
Isbell-Porter Co., New York City..... 794
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 792
Logan Iron Works, Brooklyn, N.Y..... 796
R. D. Wood & Co., Philadelphia, Pa..... 794
The Gas Machinery Co., Cleveland, O..... 779
The Western Gas Construction Co., Fort Wayne, Ind... 800

CHIMNEY CONSTRUCTION.
Adam Weber Sons, New York City..... 783

INCANDESCENT GAS LAMPS.
Ball Check Light Co., New York City..... 779
Detroit Arc Gas Light Co., Detroit, Mich..... 777
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 780
Welsbach Company, Gloucester, N. J..... 786

BURNERS.
C. A. Gefrorer, Philadelphia, Pa..... 780
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 780
Wm. M. Crane Co., New York City..... 781

LAVA GAS TIPS.
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 780

STREET LAMPS.
Thos. T. W. Miner, New York City..... 781
Welsbach Street Lighting Co., New York and Phila.... 786

PURIFIERS.
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 792
R. D. Wood & Co., Philadelphia, Pa..... 794
Stacey Mfg. Co., Cincinnati, O..... 795
The Western Gas Construction Co., Fort Wayne, Ind... 800
Connelly Iron Sponge and Governor Co., New York City 783

PURIFYING MATERIALS.
Connelly Iron Sponge and Governor Co., New York City 783

VALVES.
Continental Iron Works, Brooklyn, N. Y..... 794
Isbell-Porter Co., New York City..... 794
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 792
Ludlow Valve Manufacturing Co., Troy, N.Y..... 781
R. D. Wood & Co., Philadelphia, Pa..... 794
The P. H. & F. M. Roots Co., Connersville, Ind..... 743
The Western Gas Construction Co., Fort Wayne, Ind... 800

EXHAUSTERS.
Connelly Iron Sponge and Governor Co., New York City 783
Isbell-Porter Company, New York City..... 794
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 792
The Connersville Blower Company, Connersville, Ind... 793
The P. H. & F. M. Roots Co., Connersville, Ind..... 743

ELECTRICAL APPARATUS.
Wm. Henry White, New York City..... 795

PURIFIER SCREENS.
John Cabot, New York City..... 789

GAS STOVES.
American Meter Co., New York and Philadelphia..... 785
Keystone Meter Co., Royersford, Pa..... 798
Maryland Meter and Manufacturing Co., Baltimore, Md 798
Nathaniel Tufts Meter Co., Boston Mass..... 798

HOT WATER HEATERS.
The Humphrey Mfg. and Plating Co., Kalamazoo, Mich. 784

GASHOLDER TANKS.
J. P. Whittier, Brooklyn, N.Y..... 782

GASHOLDERS.
Bartlett, Hayward & Co., Baltimore, Md..... 795
Continental Iron Works, Brooklyn, N.Y..... 794
Davis & Farnum Mfg. Co., Waltham, Mass..... 792
Delly & Fowler, Philadelphia, Pa..... 796
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 792
Logan Iron Works, Brooklyn, N.Y..... 796
R. D. Wood & Co., Philadelphia, Pa..... 794
Riter-Conley Mfg. Co., Pittsburg, Pa..... 796
Stacey Mfg. Co., Cincinnati, O..... 795

STORAGE TANKS.
Christopher Cunningham, Brooklyn, N.Y..... 789

AUTOMATIC SCALES.
Richardson Scale Co., New York City..... 780

INVESTORS.
W. R. Faben Construction Company, Toledo, O..... 780

PATENTS, TRADE-MARKS, COPYRIGHTS.
Royal E. Burnham, Washington, D. C..... 710

BOOKS, ETC.
Coal Tar and Ammonia..... 780
Gas Analyst's Manual..... 796
Field's Analysis, 1901..... 798
Gas Flow Computers..... 791
Excerpts from Reports of Gas Commissioners..... 759
Directory of Gas Companies..... 795
Gas Engineer's Laboratory Handbook..... 794
Gas Engineer's Pocket-Book..... 788
Poole on Fuels..... 791
Practical Handbook on Gas Engines..... 791
Hughes' "Gas Works"..... 780
Binders..... 791

MECHANICAL ENGINEER.

An experienced mechanical engineer, being an all-round, practical mechanic, designer of a well thought out line of modern, large

TANDEM GAS ENGINES,

in commercial sizes, between 100 and 1,000-horse power, adapted to drive electric generators at highest economy, using producer or waste furnace gases, or crude oil as fuel, desires connection with capital or manufacturing interests. Exceedingly large profits can be demonstrated to inquirers' own engineers. Four patents pending.
1457-4 Address, "Z. X. Y.," care this Journal.

WANTED,
Position as Manager of a Gas Company

That is much in need of a man thoroughly familiar with all details of the business. A position where the business and public confidence are much impaired, requiring the right man, at the right place, at the right time, preferred.
1458-tf Address, "ABILITY," care this Journal.

POSITION WANTED.

A-1 designer of coal and water gas plants, having 25 years' experience in erecting, and good inventor, capable of operating and taking charge of any gas works on Continent, desires a situation as foreman of works, or with some good erecting firm. Address, "J. A. B.,"
1458-1 Care this Journal.

Position Wanted
AS MANAGER.

By a successful hustler for new business. Experienced in selling gas stoves; laying high and low pressure mains; understands the manufacture of coal and water gas in detail; also, reconstruction of benches and water gas apparatus. Superintendent of gas company for a number of years. Will find me up-to-date and energetic young man. Can furnish best of references. Address, "PUSHER,"
1457-5 Care this Journal.

WANTED,
Situation as Superintendent of a Gas Company,

By a man of 36. Fifteen years' experience in the management of coal and water gas plants. Have been very successful in getting new business. Up-to-date in every detail and new methods of pushing the gas business. Can furnish good references. Good reasons for wishing to make a change.
1457-2 Address, "S. F.," care this Journal.

Position Wanted
AS MANAGER OF A GAS COMPANY,

By a man thoroughly competent. Am successful in all details of the business, with several years' experience,
1452-tf Address, "G. A.," care this Journal.

WANTED,
AN EXPERIENCED GAS MAKER,

To operate new machine. Steady employment and good wages.
Address, MOHAWK GAS COMPANY,
1457-2 SCHENECTADY, N. Y.

Apparatus Wanted.
FOUR SECOND-HAND PURIFIERS,

Ten feet by 12 feet by 4 feet, with 10 inch connections and seal, complete. Parties contemplating a change to larger boxes, adddress,
1455-4 GAS CO. OF WEST CHESTER, Westchester, Pa.

FOR SALE.
One 5 Feet 6 Inches Water Gas Set,

Complete in every detail. New in February. Will be operated until August, when larger machine will be ready. Address,
1458-3 MOHAWK GAS CO., Schenectady, N. Y.

FOR SALE,
One No. 6 Isbell-Porter Exhauster.

Almost new. Capacity per hour, 20,000 cubic feet, at 75 revolutions. Engine, 5 inches by 6 inches, and on same bedplate. Connections, 12 inch, with by-pass, tees and bends, and two 12 inch valves. Price, f.o.b. cars, $975.
Address, ROCHESTER GAS & ELECTRIC CO.,
1458-2 Rochester, N. Y.

FOR SALE, CHEAP.

Four purifying boxes, 6 feet by 6 feet by 2½ feet, with 6 inch connections. Complete, with seal and all connections.

One purifying box, 10 feet by 10 feet by 3 feet.

One 12-pipe condenser, 6½ feet long, 20 inches wide and 10 inches deep, with 6 inch connections. All in first class condition.

Address, MARQUETTE GAS LIGHT CO.,
1454-tf MARQUETTE, MICH.

FOR SALE

One Set of 8 Feet by 10 Feet by 4 Feet Deep Purifiers.

Complete, with dry centerseal and all connections, ready for immediate shipment.

Address, ANN ARBOR GAS COMPANY,
1457-2 Ann Arbor, Mich.

FOR SALE.

5-FOOT WATER GAS APPARATUS.

Address, CHARLES G. M. THOMAS,
1449-tf Flushing, N. Y.

FOR SALE.

One High Pressure Roots' Exhauster and Engine,

On one bed. This machine is practically new, and has been delivering 100,000 per day, through 8 miles of 4 inch pipe line. Engine is direct connected to exhauster, and with them is included one cooling tank and all 8-inch connections.

1457-tf Address, "F. R. V.," care this Journal.

WANTED,

To Lease or Buy

A coal gas works in a town of 10,000 to 20,000 inhabitants. Central or Middle West preferred. Replies strictly confidential.

1458-2 Address, "BUSINESS," care this Journal.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to

STRCH & GSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

1903. NEW DETROIT 1903.

Force Draft

ARC GAS LAMP,

With double flash pilot. We save 25 per cent. gas over any other arc and produce more candle power. To light consumption what the gas range is to fuel.

A Handsome Fixture. Always in Order.

We will send one or more lamps on 30 days' trial to Gas Companies who maintain the lamps. Write for quotations and circulars. We will save you money.

Detroit Arc Gas Light Company,

67-71 Michigan Avenue, Detroit, Mich.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are being furnished for Detroit, Mich.

These are the only machines that will draw or charge simultaneously three or four retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Can., working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,

Contracting Engineer and Builder,

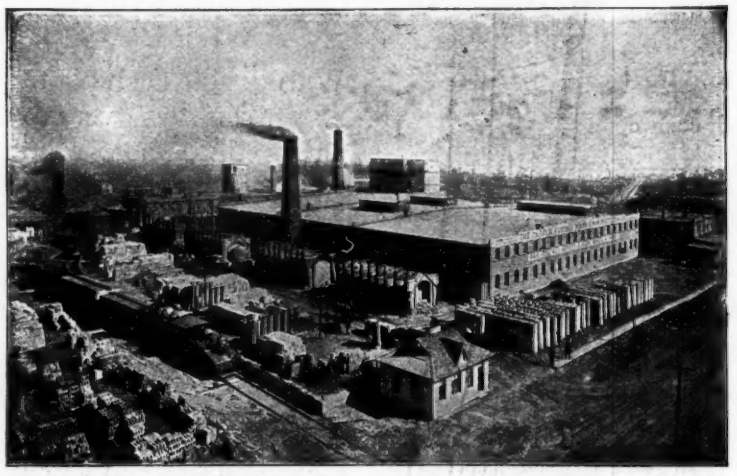
229 BROADWAY, NEW YORK.

PARKER-RUSSELL MINING AND MFG. CO.,

PROPRIETORS OF THE

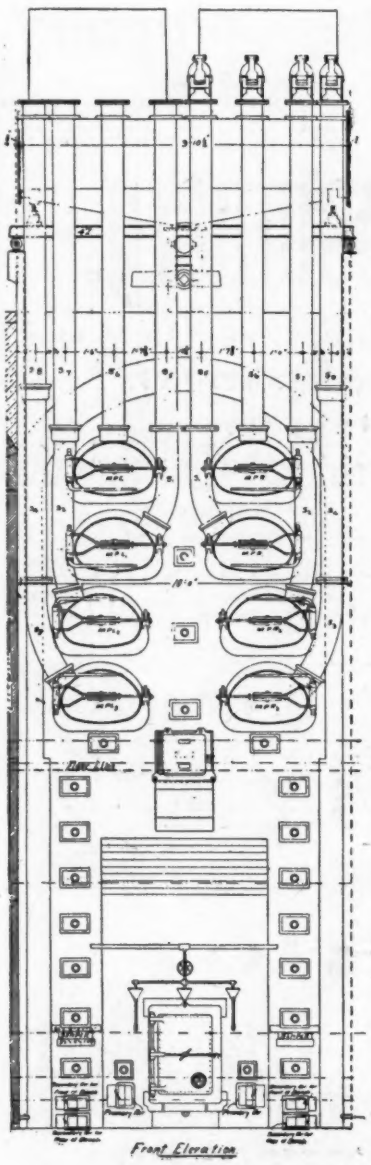
OAKHILL GAS RETORT AND FIREBRICK WORKS.

St. Louis Office:
417 Pine St.



FACTORY AT ST. LOUIS, MO.

New York Office:
Aldrich Court,
45 Broadway.



Front Elevation

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

SLOPERS.--We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

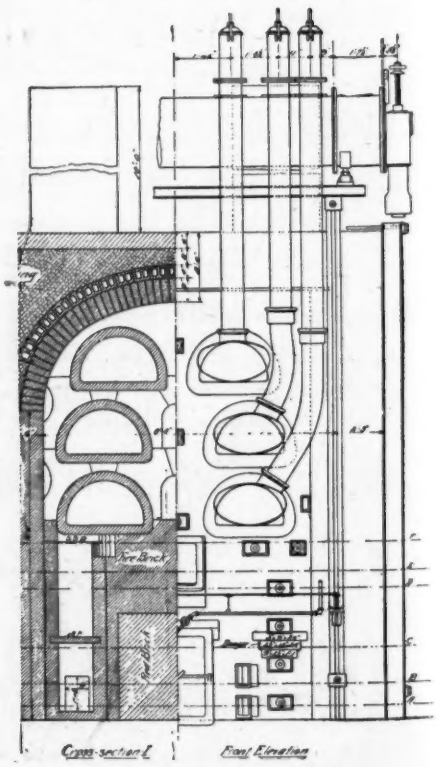
We build Benches complete, ready for gas making. Also

RETORT HOUSES,

COAL AND COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates cheerfully furnished.

CORRESPONDENCE SOLICITED.



Cross-section E. Front Elevation

The Ball Check.

Pat. Nov 25, 1902.

ANY BURNER.

ANY GAS--ANY PRESSURE.
INSTANT ADJUSTMENT.

HIGHEST EFFICIENCY.

"JUST A TWIST OF YOUR WRIST AND YOUR LIGHT IS BRIGHT."

"THE BALL DOES IT ALL."

Triple Arc Ball Check Lamp fits any chandelier or gas bracket. Three times the light of the single mantle burner, yet burns only double the amount of gas. More light—less gas. Greatest illuminator in the world for the money.

Send for the Ball Check Light Booklet.

BALL CHECK LIGHT CO.,
16 AND 18 PARK PLACE,
NEW YORK.

NEW ENGLAND BALL CHECK LIGHT CO.,
161 FRANKLIN STREET,
BOSTON.

FRANK D. MOSES

Long Distance Telephone, 1922, Trenton, N. J.

TRENTON, N. J.,

Long Distance Telephone, 1922, Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

P. PLANTINGA, President. W. E. STEINWEDELL, Secretary.

THE GAS MACHINERY CO.,

OFFICES: 720-722 CITIZENS BUILDING,

CLEVELAND, OHIO.

Coal and Water Gas Apparatus, Bye-Product Machinery, Structural Work and Connections.

STEWARD LAVA TIPS.

ALL SIZES. ALL KINDS.

Greatest care is used in selection of material and making.

YOU CAN GET ANY QUANTITY PROMPTLY FROM OUR THREE BRANCHES.

THE D. M. STEWARD MFG. CO., ESTABLISHED 1876.

NEW YORK: 8–12 JAY STREET

CHICAGO: 57 WASHINGTON STREET.

FACTORY AND GENERAL OFFICE: CHATTANOOGA, TENN.

Gas Analyses of All Sorts and Conditions,

—OR—

Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,

1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

IN THE MARKET.

WE PURCHASE:

Gas properties.
Electric light properties.
Street railway properties.
Also desirable franchises.

W. R. FABEN CONSTRUCTION CO.,

1393-tf 317 St. Claire Street, Toledo, O.

PATENTS, TRADE-MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

Send for Pamphlet on Patents.

1418-tf

AUTOMATIC SCALES

Send for Catalogue.

RICHARDSON SCALE CO., 21 Park Row, NEW YORK CITY.

GAS BURNERS,

To burn a given amount at a stated pressure made to order. Samples furnished. Also, small oil and air valves, slow-feed valves for high pressure, and small brasswork in general.

Drip Pumps, Service Cleaners, Gasfitters' Proving Pumps and Mercury Gauges.

C. GEFRORER & SON,

248 North 8th Street, Philadelphia, Pa.

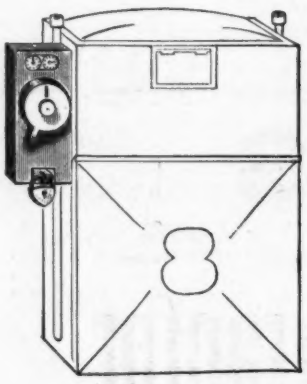
HUCHES' "GAS WORKS,"

Their Construction and Arrangement, and the Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E. Rewritten and much enlarged by WM. RICHARDS, C.E.

Eighth Edition Revised, with Notices of Recent Improvements **Price, $1.65.**

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.



THE **REEVES PREPAYMENT ATTACHMENT**

HAS ADVANTAGES POSSESSED BY NO OTHER DEVICE OF THE KIND.

FATAL ACCIDENTS CAUSED BY

CONSUMERS PUTTING COIN IN METER AND SO TURNING GAS ON IN SLEEPING ROOMS WHERE IT HAD GONE OUT **CANNOT OCCUR** WITH THE **REEVES,** AS THE LIGHT DROPS TO A VERY SMALL ONE, BUT DOES NOT GO OUT FOR 10 OR MORE HOURS, AND AMOUNT OF GAS SO USED IS AUTOMATICALLY DEDUCTED FROM NEXT PREPAY. HAS OTHER GREAT ADVANTAGES. FITTED TO ANY MAKE OF METER. $10 CAN BE PREPAID AT ONE TIME. DEVICE CANNOT BE **"BEATEN."**

REEVES MFG. CO., - - - NEW HAVEN, CONN.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,

ENGINEERS AND BUILDERS OF GAS PLANTS.

Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.

Special High Grade Material for Recuperative Furnaces.

Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS.

COAL TAR AND AMMONIA.

THIRD AND ENLARGED EDITION.

BY

GEORGE LUNGE, PH.D.

Price, $15. For Sale by

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

BRAY BURNERS

Of Uniform Excellence and Greatest Candle Power.

BEWARE OF IMITATIONS.

WILLIAM M. CRANE CO.,

1131-1133 Broadway, New York,

SOLE AGENTS FOR UNITED STATES.

Have you seen Bray's new "LUTA" burner for acetylene gas?

Automatic Back Lever. No. 970210.

Steel Coal Tubs.

Do you need coal tubs? If so, write to us for particulars and prices of sizes needed. We have had thirty-one years' experience in building tubs, and can supply you with those you need.

We carry in stock sizes varying from one-fifth ton to 1 ton, and can ship immediately.

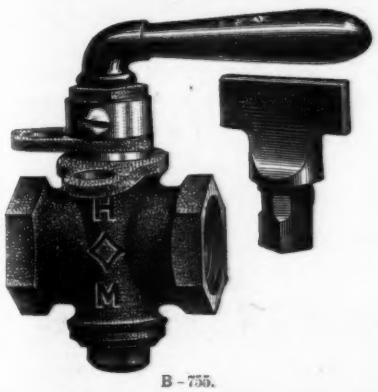
Write for Catalog 021.

Side Catch. No. 0277.

C. W. Hunt Company,
New York Office: 45 Broadway.

Works and Office:
West New Brighton, Staten Island, N. Y.

Mueller Gas Cocks.



B-755.

TOO little is not as much as you pay for, and too much is more paid for than you need.

In **Mueller Gas Cocks** you find a happy medium--not so little metal as to leave them weak, nor yet so much as to make them costly.

Made in 145 styles, seven sizes in each style.

MADE ONLY BY

H. MUELLER MFG. CO.,

DECATUR, ILLS., U. S. A.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

"THE MINER"

Globe

Street and Boulevard

Lamps.

Cheapest and Best.

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

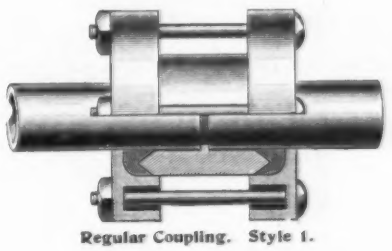
THOMAS T. W. MINER,

821-823 Eagle Av., N.Y.

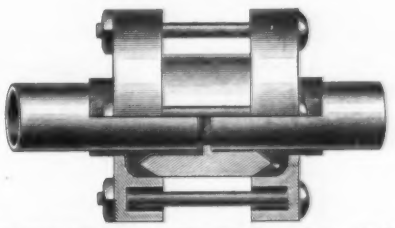
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

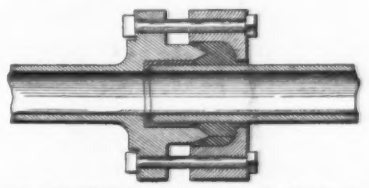
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



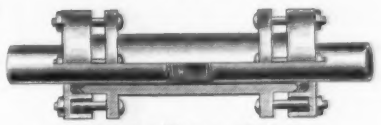
Regular Coupling. Style 1.



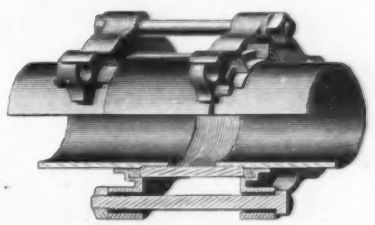
Insulating Coupling for Wrought Iron Pipe Style 5.



Insulating Coupling for Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

LLOYD CONSTRUCTION COMPANY,

DETROIT, MICH.

LOWE DOUBLE SUPERHEATER WATER GAS APPARATUS.

Coal Gas Condensing and Scrubbing Apparatus.
Purifiers with Plain or Reversing Center Valves.
The Lloyd System of Valve Connections.
PLAIN OR REVERSING (PATENT APPLIED FOR).
Oxide, Coal and Coke Elevators and Machinery.
Pipe Specials, all sizes. A. G. L. Asn. Standard.
Structural Steel Work, Floors, Angle and Gate Valves.

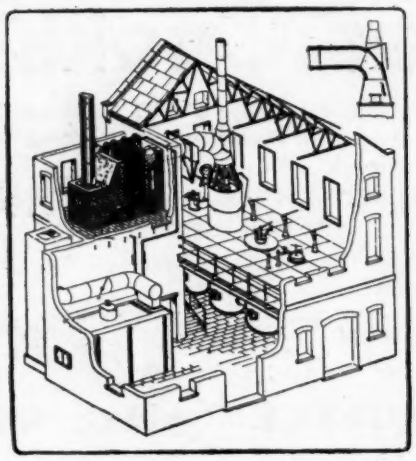
General Western Agents for BARTLETT, HAYWARD & CO., Baltimore, Md.

COAL GAS CONDENSATION SYSTEM. THE "MAYER" PATENTED TAR EXTRACTOR. THE STANDARD ROTARY WASHER-SCRUBBER. STETTIN SYSTEM INCLINED BENCHES, HYDRAULIC VALVES, ETC., ETC.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

THE GAS ENGINEERS' POCKET-BOOK.

By Henry O'Connor,

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

The Advertisement of the

P. H. & F. M. ROOTS CO., Mfrs. of Gas Exhausters, Blowers, etc.,

Connersville, Ind., - - - 120-122 Liberty Street, New York City,

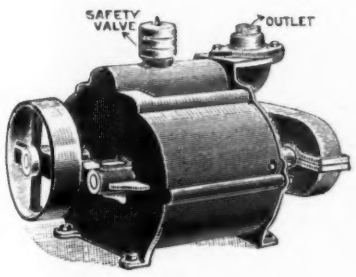
Occupies this Space Every Alternate Week.

Connelly Iron Sponge and Governor Co.,

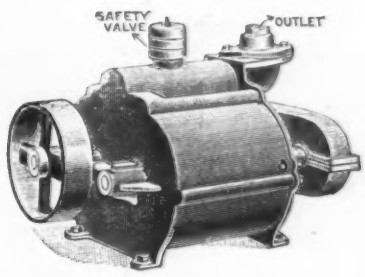
395 Broadway, New York City.

TELEPHONE, 3033 Franklin. - - - CABLE ADDRESS, Governorco.

GEO. G. RAMSDELL, General Manager. S. F. HAYWARD, Treasurer.

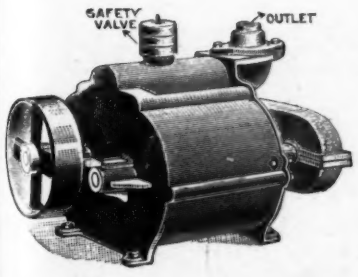


REVIVIFYING IN SITU.



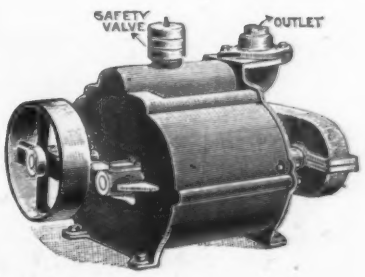
An inexpensive device for admitting air into purifying boxes. Belted direct to exhauster shaft the speed of blower is automatically regulated. Size shown in cut, 10 inches by 10½ inches by 16 inches, has a capacity of 172 cubic inches per revolution, and can be speeded to admit percentage of air desired. Specially designed for gas companies. A large number of these machines are now in daily use, giving entire satisfaction.

CORRESPONDENCE SOLICITED.



Connelly Iron Sponge and Governor Co.,

395 BROADWAY, NEW YORK CITY.



"Globe" Specials, Valves, Etc. "Glamorgan" Fire Hydrants

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON

FLANGE

GAS AND WATER PIPE

GENERAL SALES OFFICE. 192 BROADWAY. NEW YORK.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

CAST IRON GAS WATER PIPE

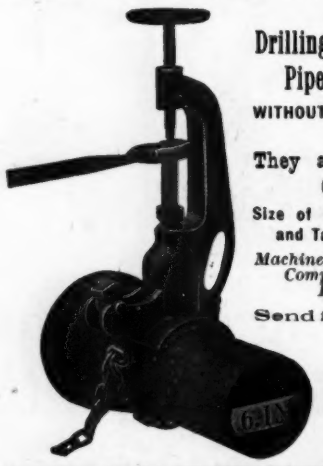
MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES



—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars

Geo. Light,

DAYTON, O.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

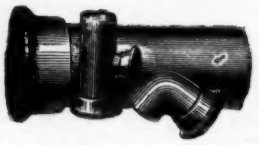
With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.



New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N. Y.

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

UTICA PIPE FOUNDRY CO.

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers and Tinners' Goods.

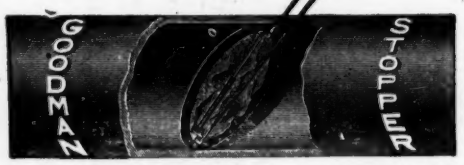
CAST IRON PIPE and SPECIALS FOR WATER AND GAS

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

THE No. 8

Humphrey Crescent Instantaneous Water Heater

IS A QUICK SELLER.

PRICE,

$20.00.

SHELF AND BRACKET FREE.

HAS NO EQUAL AT THE PRICE.

TRY ONE AND BE CONVINCED. WILL SEND ON 60 DAYS' APPROVAL.

HAVE YOU OUR CATALOGUE?

The Humphrey Mfg. and Plating Co.,

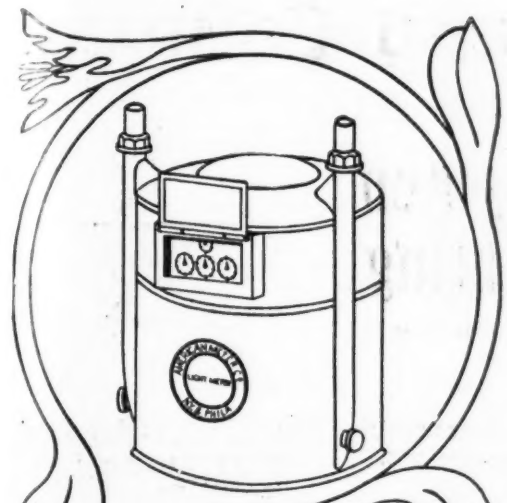
KALAMAZOO, MICH., U. S. A.

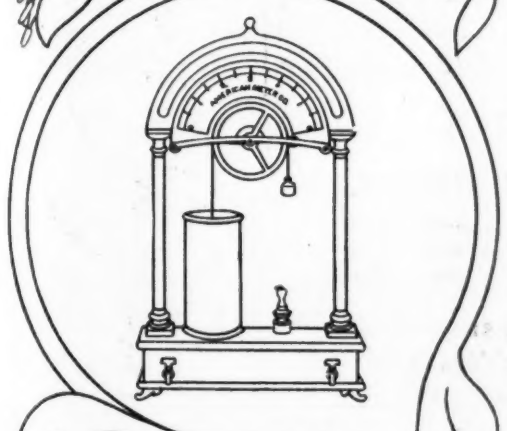
(Copyrighted, 1894, by the AMERICAN METER CO.)

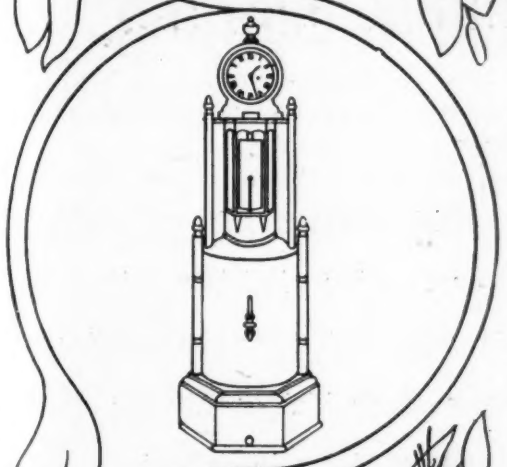
AMERICAN METER CO.

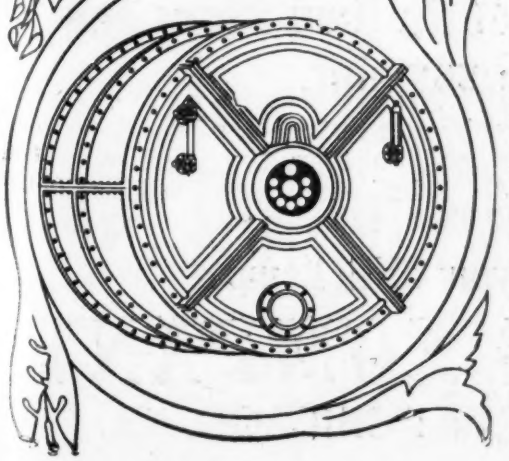
ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.









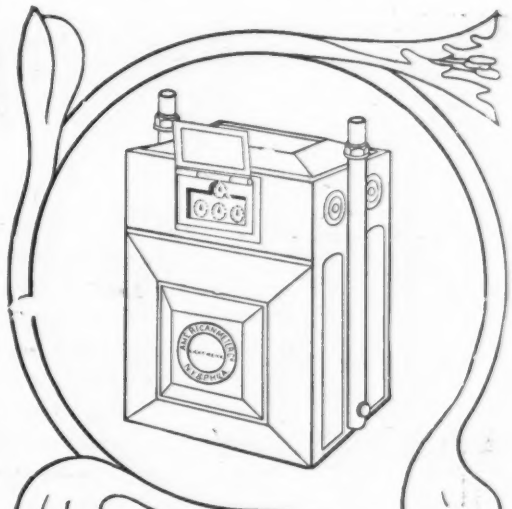
PUBLIC LIGHTING TABLE.

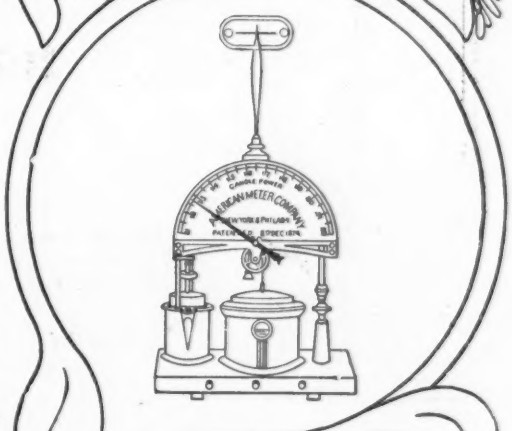
JUNE, 1903.

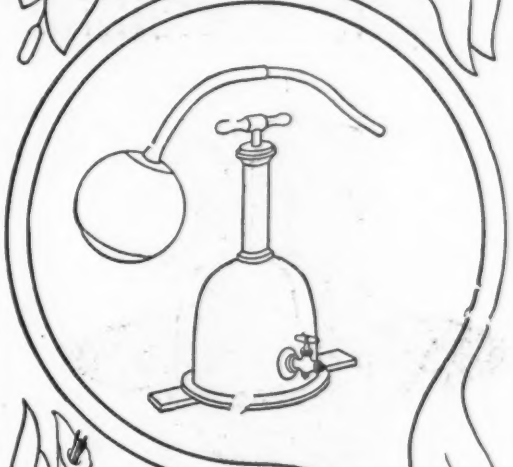
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. Extinguish.
				P.M.	A.M.
Mon.	1	11.10 PM	3.30 AM	7.15	3.15
Tue.	2	11.40 FQ	3.30	7.15	3.15
Wed.	3	12.20 AM	3.30	7.15	3.15
Thu.	4	12.50	3.30	7.25	3.15
Fri.	5	1.30	3 30	7.25	3.15
Sat.	6	2 00	3.30	7.25	3.15
Sun.	7	2.40	3.30	7.25	3.15
Mon.	8	No L.	No L.	7.25	3.15
Tue.	9	No L. FM	No L.	7.25	3.15
Wed.	10	No L.	No L.	7.25	3.15
Thu.	11	8.00 PM	9.30 PM	7.25	3.15
Fri.	12	8 00	10.20	7.25	3.15
Sat.	13	8.00	10.50	7.25	3.15
Sun.	14	8.00	11.30	7.25	3.15
Mon.	15	8.00	12.00	7 25	3.15
Tue.	16	8.00	12.30 AM	7.25	3.15
Wed.	17	8.00 LQ	1.00	7.25	3.15
Thu.	18	8.00	1.30	7.30	3 15
Fri.	19	8.00	2.00	7.30	3.15
Sat.	20	8.00	2.40	7.30	3.15
Sun.	21	8.00	3.30	7.30	3.15
Mon.	22	8.00	3.30	7.30	3.15
Tue.	23	8.00	3.30	7.30	3.15
Wed.	24	8.00 NM	3 30	7.30	3.15
Thu.	25	8.00	3.30	7.30	3.15
Fri.	26	8.00	3.30	7 30	3.15
Sat.	27	8.00	3.30	7.30	3.15
Sun.	28	8.00	3.30	7.30	3.15
Mon.	29	9.50	3.30	7.30	3.15
Tue.	30	10.20	3.30	7.30	3.15

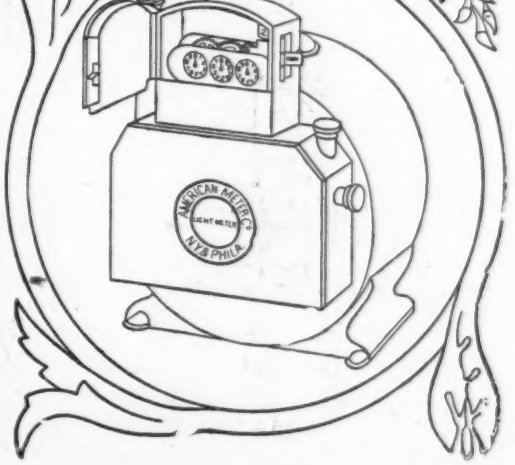
TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45





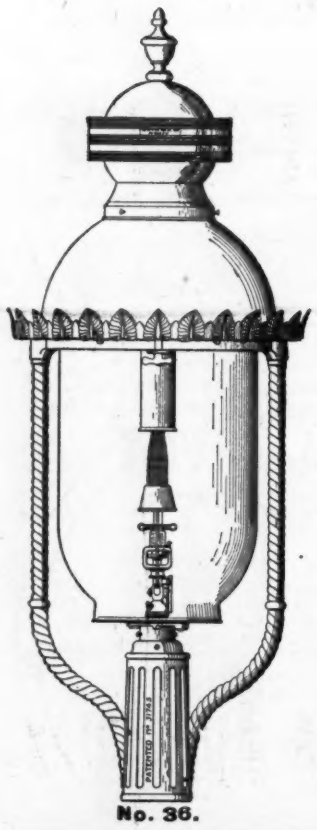




NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....


No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.

No. 38.

The Welsbach Gas Arc for Indoor Lighting.

The cut tells the story—but not all of it. Get one lamp and light it—then the tale's told from beginning to end. For one Welsbach Gas Arc Lamp is a better salesman than 20 pages of advertising.

Here's what it would show if you give it a chance to prove its worth:

1. A mechanical construction and finish that insures the greatest durability.
2. The renewal of mantles and the cleaning of globes without removal of globe.
3. The greatest amount of candle power with least consumption of gas.
4. A by-pass cock so constructed as to permit all or only one mantle burning at a time.
5. A pilot light that consumes but 1 foot of gas in 24 hours. Costs $\frac{1}{10}$ of a cent a day.

Give it a Chance to Tell its Own Story and it Won't Disappoint.

Let us send you one lamp—doesn't cost a fortune—and it will answer every question you put to it; make good on every test given it. You know the only proof of the pudding? What's the use in a fellow telling you it tastes good? Taste it yourself, then you know.

May we Send you ONE Lamp?

WELSBACH COMPANY,

GLOUCESTER, N. J., and CHICAGO, ILL.

THE UNITED GAS IMPROVEMENT COMPANY

During the Year 1902 has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Atlantic City, N. J.	Flushing, N. Y.	Norristown, Pa.
Ardmore, Pa.	Hollidaysburg, Pa.	Norwalk, O.
Auburn, N. Y.	Houston, Tex.	Ocean City, N. J.
Belmar, N. J.	Indianapolis, Ind.	Oklahoma City, O. T.
Blue Island, Ills.	Jersey City, N. J.	Oneonta, N. Y.
Boonton, N. J.	Laconia, N. H.	Plainfield, N. J.
Brooklyn, N. Y.	Lakewood, N. J.	Portland, Me.
Carlisle, Pa.	La-Salle-Peru, Ills.	Pottsville, Pa.
Champaign, Ills.	Martinsville, Ind.	Scranton, Pa.
Coney Island, N. Y.	Memphis, Tenn.	South Brooklyn, N. Y.
Dallas, Tex.	Newark, N. J.	Suffern, N. Y.
Danville, Ills.	New Brunswick, N. J.	Swedesboro, N. J.
Des Moines, Ia.	New London, Conn.	Syracuse, N. Y.
Evanston, Ills.	New Orleans, La.	Washington, N. C.
Evansville, Ind.	Norfolk, Va.	Woonsocket, R. I.

TOTAL SETS, 1902, ... 51
TOTAL DAILY CAPACITY, 1902, . . 32,825,000 cubic feet.
TOTAL SETS TO DATE, ... 447
TOTAL DAILY CAPACITY, ... 299,670,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

Works, Weber, N. J.
Main Offices, Park Row Bldg., New York.

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

OSCAR B. WEBER'S

Construction Vertical 8's (Patented). First Instalment in the World with Modern Charging and Discharging Machinery.

AGENTS FOR

GRAHAM, MORTON & CO.
LEEDS ENGLAND,
INCLINED RETORT SYSTEM.

Perforated Radial Block Chimneys.

AGENCIES.
HERBERT B. HAM, 80 Water Street, Boston, Mass.
BAKER ENGINE AND MACHINE CO., 114 N. 3d St., Phila., Pa.
JOHN T. WHEELER, 933-934 Monadnock Bldg., Chicago, Ills.

ISAAC C. BAXTER, President.
Works.
LOCKPORT STATION, PA.

ESTABLISHED 1861.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Sec'y and Treas.
Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg.
PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Dept Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
ST. LOUIS, MO.

CHRISTOPHER CUNNINGHAM,

PROPRIETOR,

THE NOVELTY STEAM BOILER WORKS,

BROOKLYN, N. Y.

STORAGE TANKS FOR GAS WORKS,

To Retain Fluid Material of Any Sort.

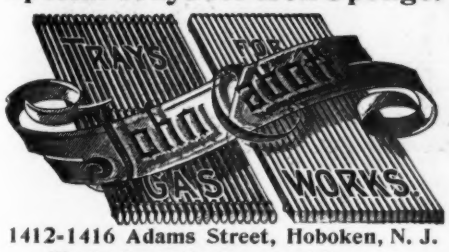
PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.

We also Supply the Chapest and Strongest

•Reversible Bolted Trays•

IN THE MARKET.

SEND FOR BOOKLET AND CIRCULARS.

Bristol's Recording

PRESSURE GAUGE.

For continuous records of

Street Gas Pressure.

Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,

Waterbury, Conn.

Silver Medal, Paris Exposition.

Jeffrey Elevating-Conveying Machinery

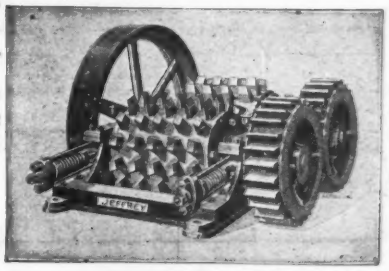
Jeffrey Detachable Chain.

FOR HANDLING

COAL, COKE, ETC.

NEW CHAIN CATALOGUE NOW READY. SEND FOR COPY.

Shaking Screens, Dump Cars, Power Transmission Machinery, Chains, Elevator Buckets, Sprocket Wheels, Crushers, Screens, Cable Conveyors, Spiral Conveyors, Etc.



Coal and Coke Crushers.

ADDRESS

THE JEFFREY MFG. COMPANY,

COLUMBUS, OHIO, U. S. A.

NEW YORK : : : CHICAGO : : : DENVER.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $2.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

Gulf Refining Company

REFINERS OF

TEXAS PETROLEUM

HIGH GRADE

GAS OIL

A SPECIALTY

REFINERIES AT
PORT ARTHUR, TEX.

GENERAL OFFICES
FRICK BUILDING
PITTSBURG, PA.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

EDMUND H. McCULLOUGH, President. CHAS. F. GODSHALL, Treasurer. H. C. ADAMS, Secretary. HENRY WHARTON, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE LINK-BELT MACHINERY CO.,

ENGINEERS, FOUNDERS, MACHINISTS,
Chicago, U. S. A.

"Link-Belt" Breaker.

Tilting Coal and Coke Cars, Breaker Rolls, Power Transmitting Machinery.

LINK-BELT ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC

Machinery designed and erected to suit existing conditions and available space.

Special Catalogue No. 31 Sent upon Application.

PHILADELPHIA, LINK-BELT ENGINEERING CO.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

PRACTICAL HANDBOOK ON

GAS ENGINES,

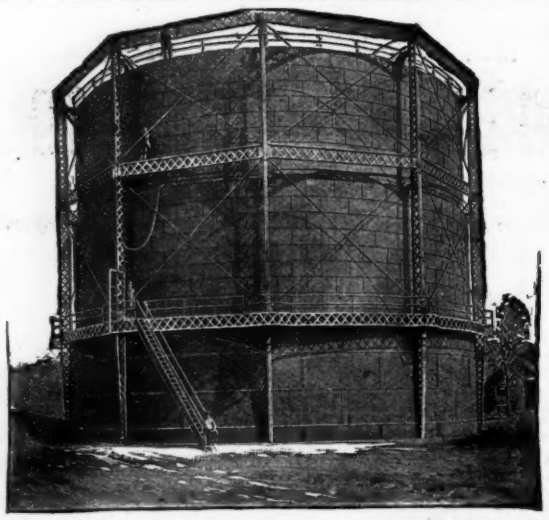
With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the Author, by GEO. M. RICHMOND, M.E.

PRICE, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING.

Rooms 201 & 202. **DETROIT, MICH.**

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

BREVARD, N. C.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Practical Photometry,

By William Joseph Dibdin

Price, - - - - $3.00.

FOR SALE BY

A. M. CALLENDER & CO.,

No. 42 Pine Street, New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

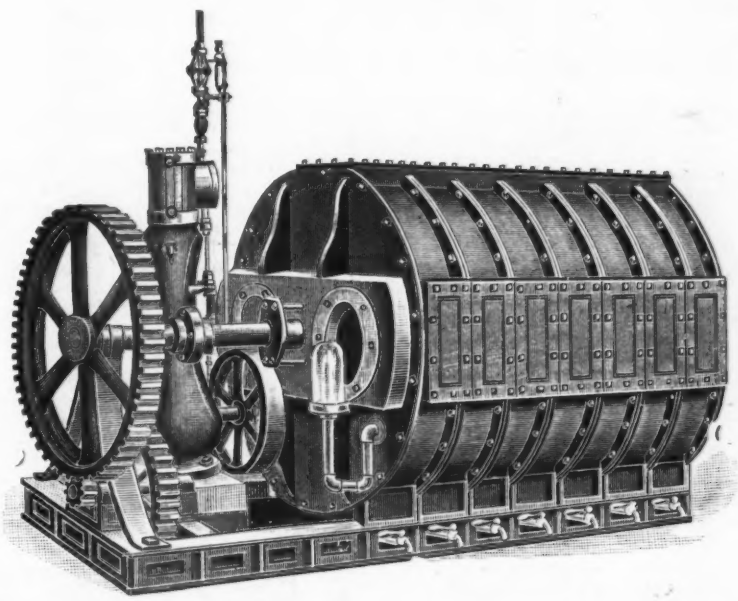
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S. W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED.

COMPLETE EXAMINATIONS MADE.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single, Double and Triple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

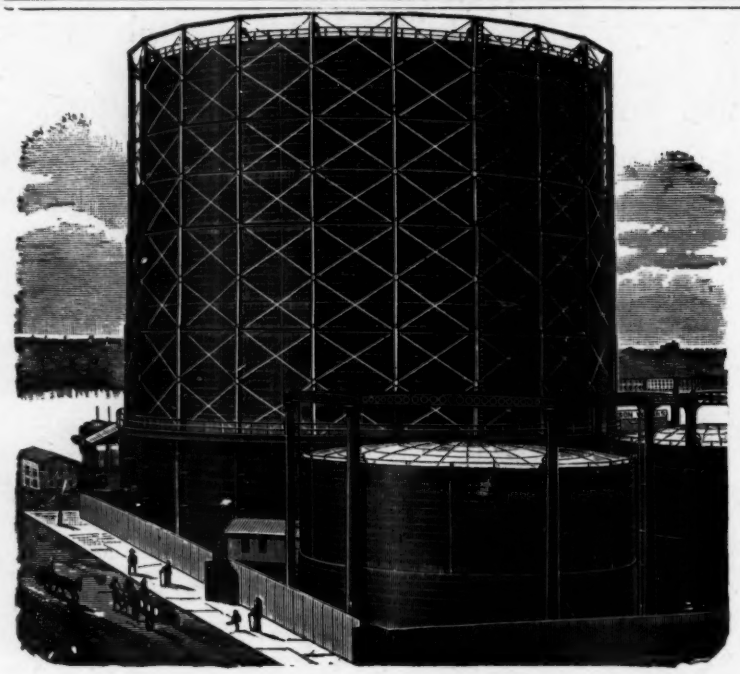
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— Bridge & Ogden Sts., Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, JR., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries),
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2 50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

THE STACEY MANUFACTURING CO.,

MANUFACTURERS OF

Gasholders, Steel Tanks,

AND ALL IRONWORK AND MACHINERY REQUIRED IN A GAS PLANT.

ALSO THE ONLY AUTHORIZED MANUFACTURERS OF

The Chollar System of Gas Purification.

OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

PLANS, SPECIFICATIONS AND ESTIMATES CHEERFULLY FURNISHED.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

No. 62 Wall Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

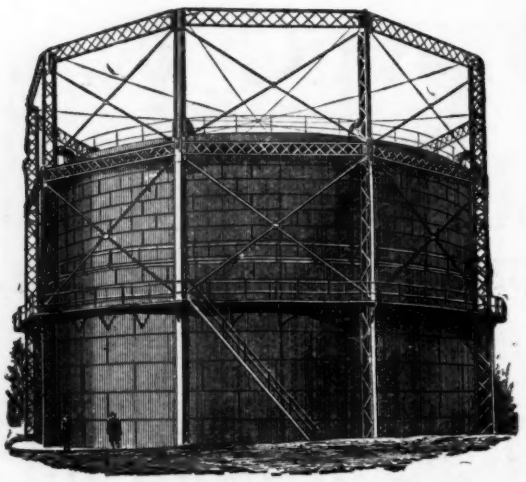
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1902 DIRECTORY 1902

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ※ Deily & Fowler, ※ 1903

LAUREL IRON WORKS.

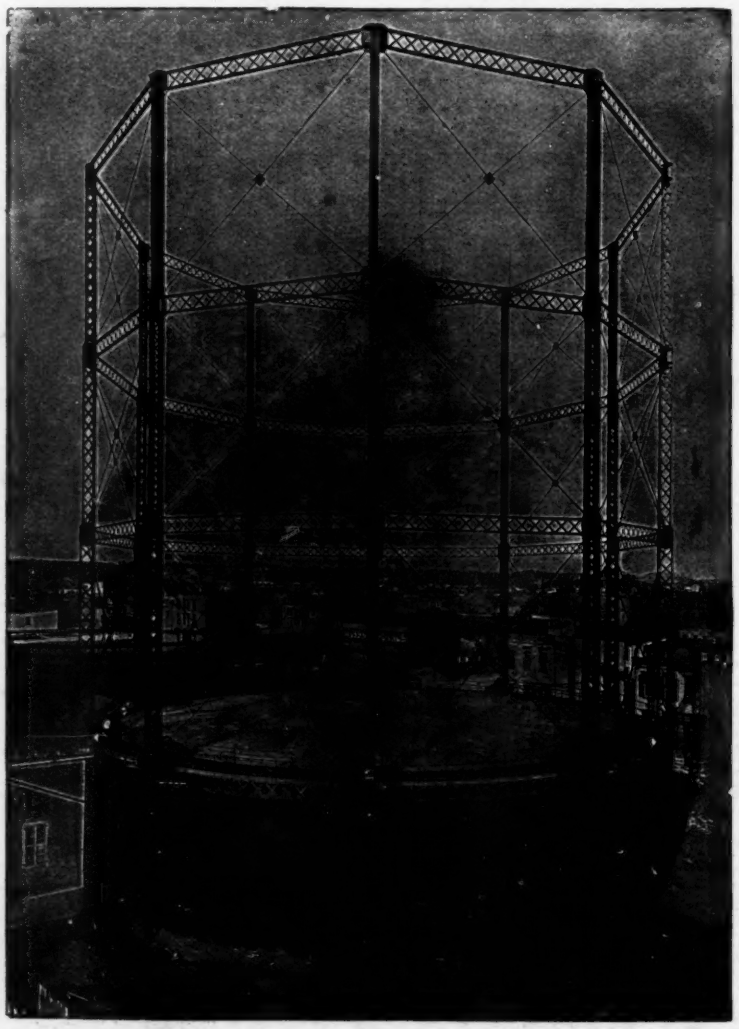
Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu.Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,
Self-Sealing Retort Lids,
AND ALL PARTS OF
GAS WORKS APPARATUS.

Contractors for Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S
HOT GAS SCRUBBER.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.
Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

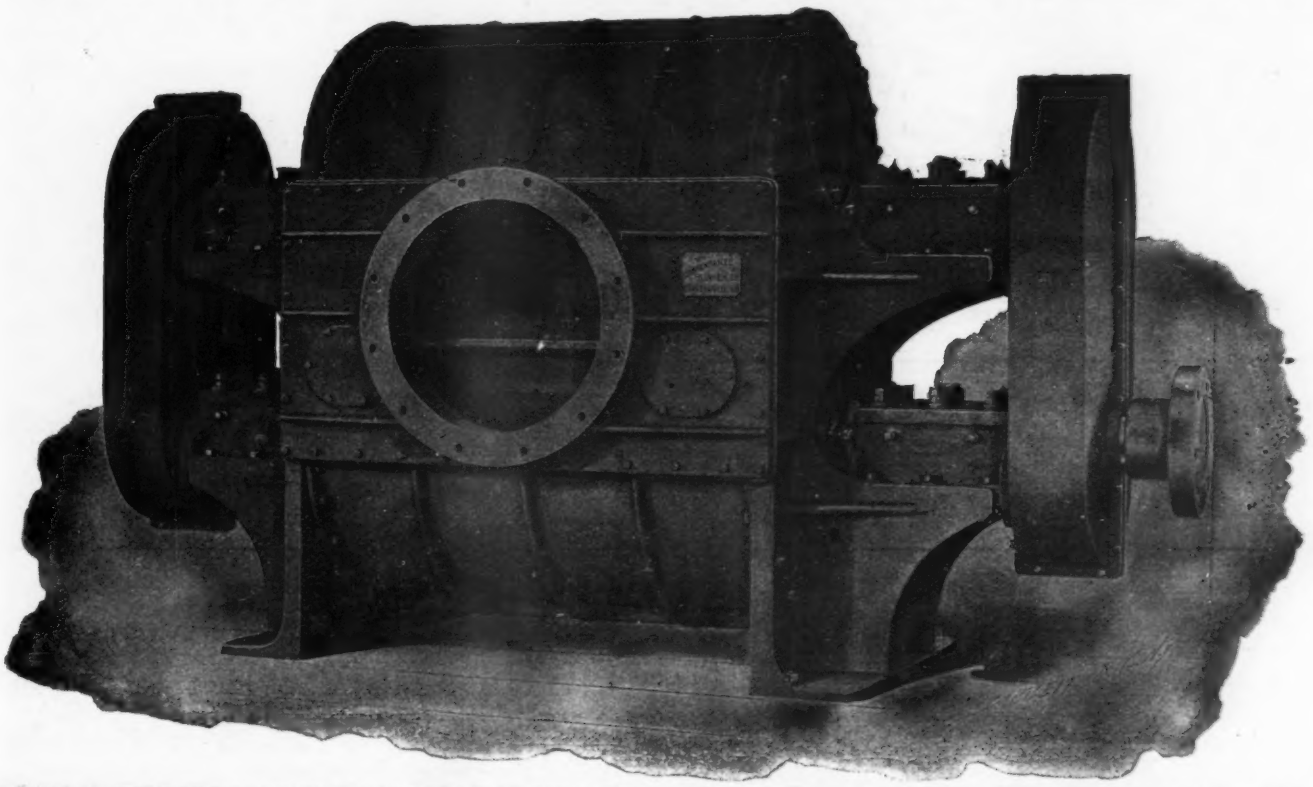
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

NATHANIEL TUFTS METER CO.,

ESTABLISHED 1849.

8 MEDFORD STREET, BOSTON, MASS.

Consumers' Dry Gas Meters.
Station Meters of Any Capacity.

PREPAYMENT GAS METERS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

ANTICIPATE YOUR WANTS

Just now, as the freight traffic is so congested it is no longer safe to count on a prompt delivery, then send us your orders for immediate attention, and we will fulfill your happiest anticipations.

KEYSTONE METER CO.,
ROYERSFORD, PA.

FIELD'S ANALYSIS
For the Year 1901.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 33d Year of Publication. Compiled and Arranged by

JOHN W. FIELD,

Secretary and General Manager of The Gas Light and Coke Company, London

Price $5. For Sale by
A. M. CALLENDER & CO., - No. 42 Pine Street, N. Y. City.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO,
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

THEODORE D. BUHL, President. CHARLES H. JACOBS, Secretary-Treasurer.

Detroit Meter Company,

DETROIT, MICH.

Manufacturers of . .

GAS METERS of the HIGHEST QUALITY

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

We've an awful lot of work on hand, but still have room for yours.

FOR PROMPT ATTENTION, WIRE.

The Western Gas Construction Company,

FORT WAYNE, IND.